SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXI.—No. 2. ESTABLISHED 1845. NEW YORK, JULY 8, 1899. [$3.00 A YEAR. WEEKLY.

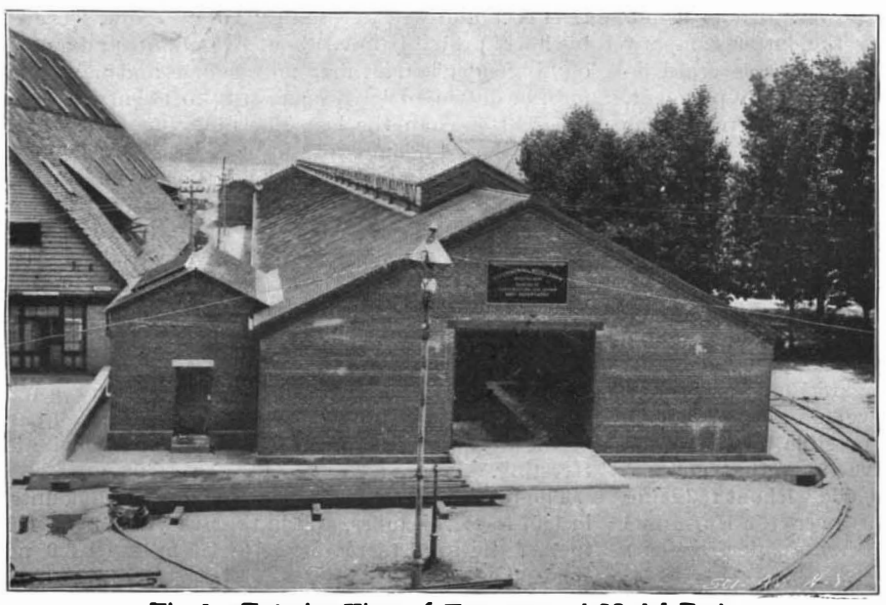

Fig. 1.—Exterior View of Experimental Model Basin.

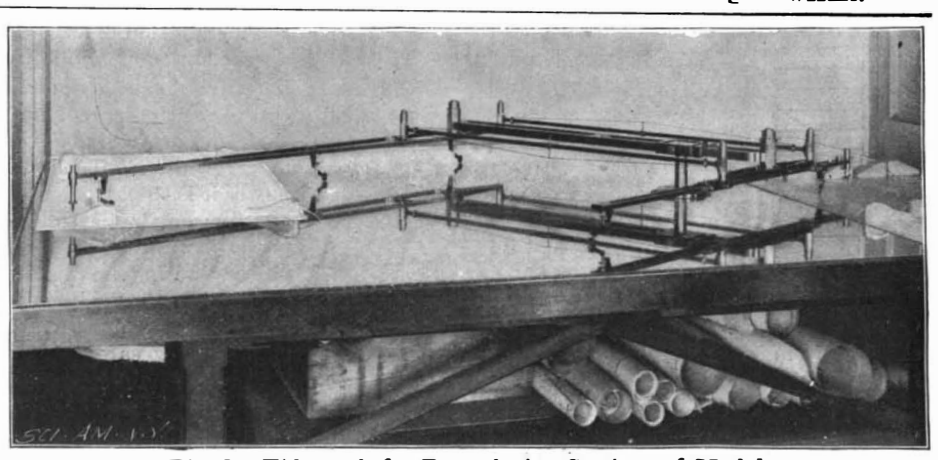

Fig. 2.—Eidograph for Reproducing Sections of Model.

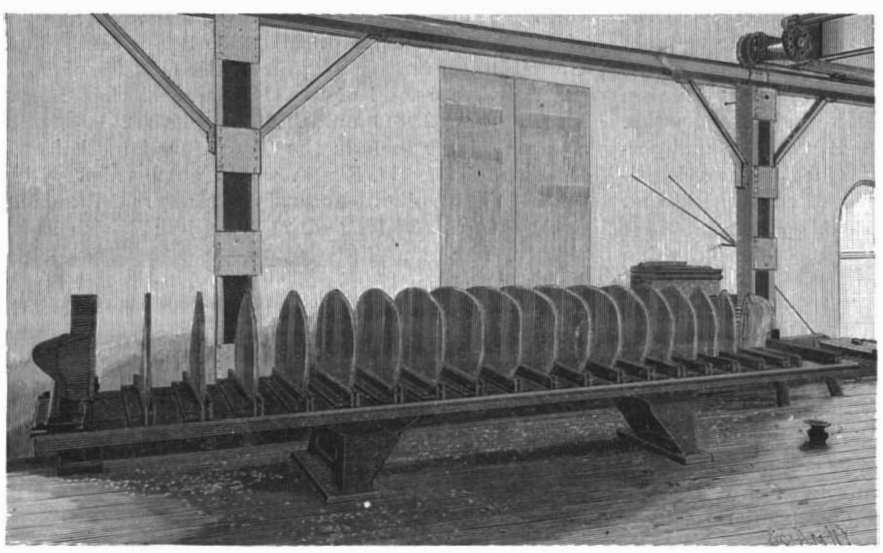

Fig. 3.—Board Sections for Making "Former" Model, on Erecting Table.

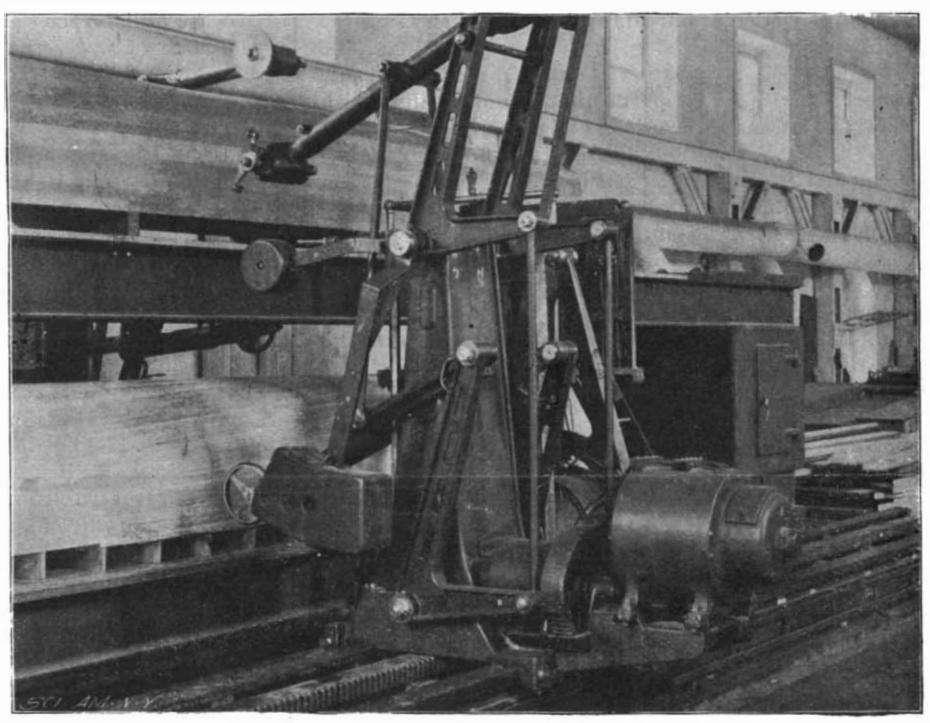

Fig. 4.—Model-Cutting Machine. ("Former" is Below, Model Above.)

Fig. 5.—Interior View Showing Basin and Towing Carriage.

THE UNITED STATES EXPERIMENTAL MODEL BASIN.—[See page 25.]

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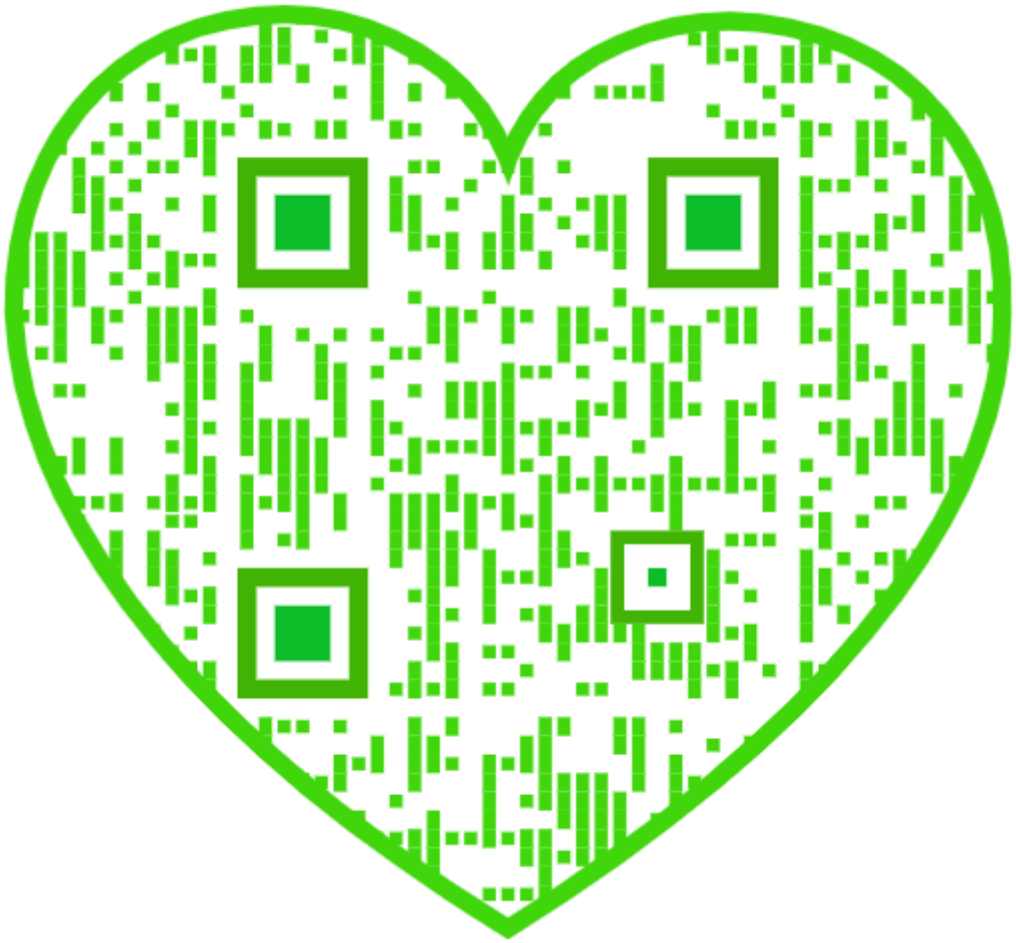

Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, JULY 8, 1899.

JAPAN AND THE INTERNATIONAL PATENT UNION.

The good work that has been done by the American Commission on international patent regulations will show fruit in the entrance of Japan into the International Patent Union, an event which is to take place in the near future. Although Japan has a patent system of her own under which the native inventors are fully protected, the government has hitherto refused to afford protection to foreign inventors. This has worked a particular hardship with respect to a country whose people are so strongly imitative as the Japanese. A foreign visitor to Japan is astonished to find the factories and workshops of that country filled with clever imitations of American and European tools and appliances. While the Japanese are not wanting in originality, they excel in their powers of adaptation and imitation, and it has hitherto been a decided hardship to American manufacturers to see their very best and latest devices put into such extensive use with no resulting benefit to themselves. Bad as it has been in the past, the matter would have become yet more vexatious in view of the prospective growth of trade between this country and Japan. After July of this year patent protection will be afforded to foreigners on strictly the same terms as those given to natives, and that enterprising country will present an attractive field to inventors in this country.

AMERICAN ORDNANCE FOR RUSSIA.

It was recently announced in The New York Commercial that the Russian government had decided to expend a large amount of money, amounting to many millions of dollars, in the purchase of artillery from American manufacturers of ordnance. If this should prove to be correct, it would only be in keeping with the line of policy pursued by Russia of late years, and particularly during the past twelve months, in accordance with which she has placed a large part of her orders for naval and military material abroad, and a considerable portion of it with American builders and manufacturers. Messrs. Cramp & Sons have now upon the stocks a first-class battleship and cruiser for the Russian navy, and although it is true that their ordnance is to be supplied from abroad, we have felt satisfied that it was only a matter of time when we should begin to supply guns as well as ships to foreign nations. Indeed, in the matter of small ordnance, our reputation was made more than half a century ago, and the uniformly good quality of the heavy artillery now turned out by our army and navy shows that our skill is not confined to the smaller class of weapons.

THE THIRD-RAIL SYSTEM ON THE NEW YORK ELEVATED RAILROADS.

Following upon many months of rumor come two definite statements by the President of the Manhattan Elevated Railway Company, made at a meeting of the Executive Committee, to the effect that the company has purchased the ground for its electric power house and that a contract has been given for 9,000 tons of third rail. The site for the power house measures 204 ×570 feet, and affords abundant space to install electrical power sufficient for the whole of the present system and a future growth of fully fifty per cent.

It is scarcely possible to overestimate the importance, from an electrical point of view, of this move on the part of New York's greatest system of transit. In view of the length of the track, the number of trains run and passengers carried, this will form the most important system of rapid electric transportation in the world and the comparison of operating the road by separate steam locomotives and by power generated at a great central station will afford valuable data on this subject. The third-rail system of electric traction has been in successful operation for some time on the Berlin Hartford branch of the N. Y., N. H., and Hartford Railroad, a full account of which will be found in the SCIENTIFIC AMERICAN for June 12 and 26, 1897. It has not yet been decided whether the system as installed on the elevated roads will be operated by means of trains drawn by electrical locomotives or by the multiple unit system, in which the cars can be run either singly or in trains. In any case the traveling public of this city will be the gainers both in speed and comfort of travel, while the abolition of the smoke, steam and ashes of the locomotives will prove a grateful relief to the residents of this city.

THE CANADIAN NIAGARA POWER COMPANY.

The great Niagara Power Company on the American side, with its present installation of 40,000 horse power and its provision for 60,000 horse power more, is not to be confused with the Canadian Niagara Company on the opposite shore, whose original charter called for the installation of 250,000 horse power. Under a new agreement the monopoly held by the latter company has lately been surrendered in return for several concessions. In place of making a fixed yearly payment, the company will make payments in proportion to the power which it develops. For the first 10,000 horse power it is to pay the Ontario government $15,000 per annum; on the next 10,000 horse power, $1 per horse power per annum; 75 cents for the next 10,000 horse power, and for the remaining power up to 100,000 horse power 50 cents per horse power per annum. The engineer of the Montreal Harbor Commission has recently made a very careful survey of the amount of water power at the Falls and his report shows that with the scheme of the Canadian Niagara Power Company to erect a plant capable of developing 120,000 horse power completed, it would be possible to obtain the further development of fully five times that amount above the Falls on the Canadian side without reducing the volume of water that passes over the Horseshoe Falls sufficiently to detract from their scenic grandeur.

QUESTIONABLE TUNNEL SCHEMES.

There is a veritable epidemic of tunnel discussion occurring just now in the daily press, and while the schemes are in a few cases legitimate, and the tunnels, if carried through, will doubtless be profitable, in the case of others it is difficult to conceive any reason except the sentimental one for their suggestion. The mooted tunnels beneath the East River, and possibly one tunnel beneath the Hudson River, are legitimate schemes; there is a decided call for them, and they should command ready financial support.

Among the tunnels that are of questionable value are those proposed between Great Britain and Ireland and between Great Britain and France. The English tunnel from Dover to the French coast would be from twenty to twenty-five miles in length, according to the nature of the approaches. It was ably advocated and financiered by Watkins, the great English railroad magnate, work was begun, and at one time it seemed likely to be completed. Construction was stopped, however, by order of the government, on the ground that its completion would destroy England's insular position and would constitute strategetically a menace to her safety. This reason alone will probably prevent its construction for many a decade to come.

There is now a strong effort being made to revive the Great Britain and Ireland tunnel scheme, and it seems that a largely attended meeting by the members of Parliament who have been interested in the scheme was held recently in the House of Commons. The proposed route is from County Antrim to a point near Portobello, Wigtownshire, on the Scotch coast. The distance is about twenty-five miles; the lowest depth is no less than 510 feet; and the estimated cost is $60,000,000. Judging from previous works of this kind it is probable that the final cost would be nearer $100,000,000 than $60,000,000; but even if no engineering difficulties of insuperable character should present themselves, the new route is so far removed from the present main lines of travel that it is questionable if the completed tunnel could secure sufficient revenues to cover the interest on the cost of the undertaking.

THE PASSING OF THE CENTERBOARD.

Among many rumors which have come across the water regarding the cup challenger "Shamrock," there is none that is, on the face of it, more improbable than the statement that the English boat will carry a centerboard. The fate of this ingenious contrivance, as far as big yachts are concerned, was determined in 1893, when the keel boat "Valkyrie II." easily vanquished the centerboard "Vigilant" in a fifteen-mile thrash to windward, against a stiff breeze. The "Valkyrie II." was the first of the ninety-footers to be built upon the present fin-keel principle, just as the "Vigilant" was the last of the ninety-footers to carry a centerboard. In 1895 Herreshoff boldly abandoned this time-honored device in favor of the fixed keel, the "Defender" being the first keel "single-sticker" built for the defense of the "America" cup. It is not likely that Fife has returned to a form of construction which has been abandoned by the people who so long used it and so thoroughly understood its possibilities.

Apropos of keels and centerboards, it is satisfactory to know that the "Columbia," in the few trials which she has had with the "Defender," has shown, even before she has had time to be "tuned up," that she is a somewhat faster boat. The difference is not remarkable, but it is there, and those who may feel disappointed that she has not shown a more marked superiority must remember that it is more difficult to make a gain of five minutes over a thirty-mile course in the present era of yacht designing than it was to make one of fifteen or twenty minutes a dozen years ago. In these competitive trials between the new and old cup-defenders we must remember that "Defender" is a phenomenally fast boat. In the only satisfactory race between her and "Valkyrie III." she won by nearly nine minutes, and "Valkyrie III." had even more easily disposed of "Ailsa," the Fife ninety-foot boat of that year. This would make "Defender" from fifteen to twenty minutes faster than "Ailsa." Now, "Columbia" will probably have about five minutes advantage of "Defender" on a thirty-mile course, and may, therefore, be taken to be from twenty to twenty-five minutes better than the last Fife ninety-foot yacht. To justify the confident expectations of the owner of the "Shamrock" that she will bring home the cup, she ought to beat "Britannia" (which was frequently vanquished by "Ailsa") by at least twenty to twenty-five minutes. Unless she does this in the trial races, we may regard the coming contest with considerable feelings of security.

RAILWAY MILEAGE OF THE WORLD.

In a recent issue of Archiv für Eisenbahnwesen is published the annual statistical table of the railroads of the world, a few of the figures of which will be interesting.

The total length of railroad in the world amounted in 1897 to 454,730 miles, and in the five years from 1893 to 1897 the total increase was 34,485 miles or 8·9 per cent. The same year the total length of railroad in the United States was 184,278 miles, an increase in five years of 3·6 per cent. North and South America and the West India Islands are credited with over one-half of the total mileage or 236,218 miles. Next to the United States among the great nations is the German empire, with a total of 29,880 miles, and then follows France with 25,673 miles, Russia with 25,003 miles, although, if we include the Trans-Caspian district of Russia and Siberia, Russia would come third with a total of 28,302 miles. Following France and Russia are Great Britain and Ireland, 21,390 miles; British India, 21,000 miles; Austria-Hungary, 20,908 miles; British North America, 16,684 miles; Italy, 9,714 miles; and the Argentine Republic, 9,422 miles. Belgium has the largest amount of railroad in comparison with its total area, the amount being 32·2 miles for each square mile of area.

In comparing the countries by the length of railroad compared with the amount of population that they serve, we find that the colony of South Australia stands first with 52·3 miles for each 10,000 people, this result, of course, being due to the comparative sparseness of the population. In the United States there are 26 miles to each 10,000 inhabitants. In the more densely populated districts of Europe the figures fall considerably, Germany having 5·2 miles for each 10,000 people. The small increase of 3·6 per cent in the total mileage for the United States is due to the fact that the years 1893 to 1897 were among the least active in railroad construction in the history of the country, the previous decade having been one of extraordinary increase, over 12,000 miles, or more than half the present total length of railroads in Great Britain, having been built in a single year.

THE LARGEST FLAG.

The largest flag in the world is to be exhibited under the auspices of the Daughters of the American Revolution. It was made during the Spanish-American war by Miss Josephine Mulford, of Madison, N. J. There are 325,000 stitches in the flag, one for each soldier and sailor engaged in the war. The flag is 100 feet long and 65 feet wide, and the blue ground measures 40 × 35 feet. The stripes are 5 feet wide and each star is 2¾ feet in diameter. There is also a sentimental interest connected with several of the stars of the flag, as they were made at places in the various States which are associated with the great events of American history. Thus, the Philadelphia star was partly made in the house of Betsey Ross, in the room in which she made the first American flag. Then it was worked upon at Carpenter's Hall, in the room where the first Continental Congress assembled, and partly while sitting in Hancock's chair in Independence Hall. The New Jersey star was made at Washington's Headquarters at Morristown; the Maryland star was made at Fort McHenry, in honor of Francis Scott Key; the Virginia star was made in the Lafayette room in Washington's Mount Vernon home; the New York star was partly made at Faunces' tavern, where Washington bade farewell to his officers, and it was finished on board the flagship "New York." Each of the forty-five stars is embroidered with the name of the State it represents and the date of admission into the Union. They are all arranged in chronological order. According to The New York Times, the flag is to be presented to the nation on the first anniversary of the signing of the recent Treaty of Peace.

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HONEY-BIRDS.

BY DR. EUGENE MURRAY-AARON.

There are in Africa, Australia and in South America certain birds, evidently not related ornithologically, that, because of their peculiar habits, are known as "honey-birds," the special traits of which afford an interesting study in animal reasoning or instinct as one may chose.

One of these, the species common to a large area in Central and South Africa, mentioned by many travelers, has been briefly described by that prince of realists, Dr. James Johnston, of Brownstown, Jamaica, in his superb work, "Reality vs. Romance in South Central Africa,"* at page 106. He says: "Our daily meeting with the honey-birds served to remove any skepticism I may have had in reference to this cunning little creature. It is not much larger than a canary, and as soon as man makes his appearance, hops from branch to branch, making repeated flights toward the traveler, and then flying off in the direction in which it appears to wish attention attracted, with a sustained chic-en, chic-en, chic-churr, churr, returning again and again, until its importunity is rewarded by some one accepting its invitation to follow to the spot where is stored the—to it—inaccessible treasure. It makes a great fuss, flying round and round, leaving no doubt as to the whereabouts of its find. Sometimes there is no opening to be seen, when the native proceeds to tap upon the trunk with the head of his hatchet, until he locates the hive. He then obtains the honey by making a fire at the root of the tree, and, under cover of the smoke, with his hatchet secures the prize. Then is revealed the reason for the excitement of our tiny guide, who now comes in for its share of the pickings."

Several explorers whose good fortunes have taken them well into the interior of the Australian bush have described the somewhat similar actions of a species of bird spoken of as being "nearly as large as a crow" and evidently quite distinct from the African species. In Haiti I have had opportunities of observing the like performances of a bird, shy and elusive for the most part and only at all approachable when the presence of honey renders it bold, which appeared to be closely related to our northern cedar-bird. And, if an eye not specially trained in ornithology be not at fault, the same species is to be observed on the mainland, along the middle reaches of the Orinoco, in Venezuela.

On a trip into the almost unknown wilderness around the mountain La Selle, in the southeast of Haiti, a summit which has probably not been ascended by a half dozen white men since the Columbian days, and especially on the southern slopes of that mountain, the highest peak in the West Indies, I observed a number of instances of the wonderful way in which this little creature transformed itself from a very shy, deep-shade inhabiting, and noiseless denizen of the jungles into a self-assertive, almost troublesome little tyrant, who would not take "no" for an answer or allow one to overlook or neglect its urgent, insistent appeals for aid.

I had observed the bird for some days, but being on a trip where it was impossible to be burdened with specimens other than the most portable, and being primarily an entomologist, I had paid but little attention to it, save to note how, both in coloration and flight, it closely resembled our cedar-bird and how, unlike its northern ally, it avoided the sunlight and feared man, the latter being an unusual animal characteristic in that region, where a gun is almost unknown. The wild native bees of that region, as well as the now wild descendants from the hives of the early French settlers, of a century ago, prefer the trees of the upper plateaus as home sites rather than the damper and more luxuriant lowlands, where they find most of their honey. So it was not until I had gotten well inland and begun to ascend the upper levels that I was one day electrified by the sudden whirr of one of these usually shy birds, as it flew to the ground right in my path and gave vent to the first notes I had heard uttered by any of its kind. Facing me, with wings extended and moving in a fluttering manner, much as does the bird alarmed by the presence of a snake or a cat, the little creature backed away before me, by short flights, each time, as it alighted, again facing me and uttering a cry that I can best describe as though spelled "Que, que, tr-r-r-r- ll-ll-ll-cheep!- cheép!- que!" with an ascending scale and increased volume of tone on the last three notes.

At first, I was inclined to ascribe this remarkable performance to my proximity to its nest and look upon it as its method of enticing me away from the sacred neighborhood, much as do many of our northern birds, or as does the apparently lamed or wounded mother quail, fluttering almost helplessly before the trespasser, until his distance from her scattered brood makes precipitate flight safe for her. So intent on at least discovering the nest-building plan adopted by this species, I was led on by it from point to point for a distance that seemed quite unnecessary, if my theory was correct. My native guides were lowland, sea-town men and as much at a loss to understand the bird's apparent distress as was I; but their inherent superstition made them fear to proceed. Your Haitien citizen of "La Grande République" is undoubtedly the most arrant coward and the most fear-enslaved man in all the Americas, every ready to see in the least important occurrence the displeasure of some of the minor or major spirits of the witchcraft-ridden, Obeah-worshiping world he lives in.

It was fortunate, therefore, that just then, while I was about equally engaged in assuring my companions and keeping an eye on the bird, it settled on a limb at the base of which were collected a considerable number of drone wild bees, busily engaged in going in and out of what was undoubtedly the entrance to their storehouse. My African assistants being not one whit less fond of honey than I—and wild honey is, to me, the choicest find of the woodlands—I had no trouble in persuading them that our bird, with its semi-threatening manners, was really a bearer of good tidings, rather than a harbinger of evil, although I had, even then, no inkling of the truth of this theory, advanced only to pacify my men.

With fire and our machetes we soon had the principal part of the coveted store laid bare. During the struggle with tough wood and persistent bees that had rendered this conquest of sweets possible, I had lost sight of my bird; had forgotten it, in fact. It was with no little surprise, therefore, that I suddenly noticed it in the very thick of the comb, picking and devouring, and so oblivious to its surroundings that I almost succeeded in catching it in my hand, and could easily have taken it in my insect net, had I not known that it would break its way out and render its temporary prison unfit for other and more important work.

In the days following I had several opportunities to prove that this experience was not unique, but that my little acquaintance was a veritable and infallible guide to stores of honey and that his own gratification was the end and aim of his very unbirdlike performances. To me, then ignorant of any similar discoveries of travelers, my find was unique, and it was not until I had returned to the libraries of civilization that I discovered that like avian habits had been discovered and briefly described from widely separated parts of the world.

What are we to say of the line of development whereby this habit has become natural to these various birds? How can those who deny any modicum of the reasoning faculty to the lower vertebrates explain the first steps that the ancestors of my little guide must have taken? In the early Carib or Lucayan days, or perchance even centuries before their time, when the native of those wildernesses broke open a store of wild honey, we can imagine the "honey-bird" being at the feast, an early arrival at the second table, even if not at the first of the repast, as now. But what was the first step that led finally to the threatening attitude, the menacing "cheep, cheep, que!" and the step by step guidance to the coveted goal? Who, among the upholders of "instinct," as the only guide, can answer this?

* Revel & Company, New York, 1893.

THE AUTOMOBILE INDUSTRY.

The interest in automobile vehicles is increasing from day to day. New companies are constantly being formed and the total authorized capital of the newly incorporated companies amounts, according to The Evening Post, to $163,100,000, as follows:

	Authorized capital.
The Automobile Company of America	$5,000,000
The International Vehicle Company of New York	5,000,000
The Chicago Electric Vehicle Company	2,000,000
The Woods Motor Vehicle Company of Chicago	10,000,000
The White Motor Wagon Company	10,000,000
The Lewis Motor Vehicle Company	10,000,000
The Columbia Automobile Company	3,000,000
The Illinois Electric Vehicle and Transportation Company	25,000,000
The New England Electric Vehicle and Transportation Company	25,000,000
The New York Electric Vehicle and Transportation Company	25,000,000
The Pennsylvania Electric Vehicle Company	6,000,000
The General Carriage Company of New Jersey	20,000,000
Sixteen companies incorporated for $100,000 each, by the so-called Electric Vehicle Syndicate, to operate in Tennessee, Georgia, Ohio, Kentucky, New Jersey, Louisiana, Delaware, California, Michigan, Minnesota, Iowa, Maryland, Wisconsin, Indiana, Missouri, and Virginia.	
The Canada Lewis Motor Vehicle Company	1,000,000
The National Bicycle and Motor Company	2,500,000
The Riker Electric Vehicle Company	7,000,000
The Leads Motor Vehicle Company	5,000,000
Total	$163,100,000

And these do not embrace all the companies which have been incorporated for the manufacture of automobiles; it only includes those having the largest capital.

The United States was, at one time, three or four years behind France as regards the automobile industry, but in the last year remarkable progress has been made and now we are even exporting carriages to Europe. According to The Evening Post, Baron Zuylen de Nyevelt, president of the Automobile Club de France, in his recent annual address before the club, said that there were 600 builders of motor vehicles in France, 110 in England, 80 in Germany, and 60 in the United States. It is probable that the figures as far as France is concerned are greatly exaggerated, unless the figures are intended to cover the carriage makers who simply build the bodies and buy the motors and fittings. Four exhibitions of automobiles in Europe will give great impetus to the industry. In June the Automobile Club de France held its exhibition with nearly 200 exhibitors, and the Automobile Club of Great Britain had about as many, and from July 3 to July 15 a show will be held in Agricultural Hall, Islington, London. The Berlin show will be open on September 3 and will close September 28.

SMYRNA FIGS IN CALIFORNIA.

The larger part of our fig supply comes from Asia Minor, the Spanish Peninsula and the South of France. Those of Asiatic Turkey are considered the best. Certain hymenopterous insects of the genera Blastophaga and Sycophaga which frequent the wild fig enter the minute orifice of the receptacle, apparently to deposit their eggs, conveying thus the pollen more completely to the stigmas, thus insuring the fertilization and consequent ripening of the fruit. By some the nature of the process has been questioned and the better maturation of the fruit attributed merely to the stimulus given by the puncture of the insect, as in the case of the apple, but the arrangement of the unisexual flowers in the fig renders the first theory most probable.

A year ago the Department of Agriculture began a series of experiments on the introduction of the insect which fertilizes the Smyrna fig, an agent was sent to Europe to obtain cuttings of all varieties of the wild fig and to send over the fruit containing the live insect. By good fortune some of the insects succeeded in penetrating the closed flowers of the Capri figs and laid their eggs and really established themselves in California. It is now believed that the insects will continue to breed and that in the near future a fig will be placed upon the market which possesses the same superior flavor as that which has given the imported Smyrna fig its present popularity. The flavor seems to be dependent upon the number of ripened seeds within the fruit. This feature has been ascertained through experiments in the artificial fertilization of the Symrna figs grown in California. Trials were made with the transfer of the pollen from the Capri figs by means of a toothpick and by means of a blowpipe. In this way a large number of seeds were fertilized and the characteristic flavor of the European fig was noticed.

WORK OF THE FISH COMMISSION.

The last year was the most successful in the whole history of the Fish Commission. A great part of the work has been in the collection and distribution of the eggs and fry of commercial food fish. Taking shad for instance, by the systematic collection of eggs, the distribution of shad fry, the last annual catch was 13,000,000 or an increase of 8,000,000 since 1885. At the same time the cost of shad has been decreased to the consumer more than 30 per cent. The value of the catch this year is estimated at more than $800,000. This result has been obtained by the efforts of the Fish Commission at an expenditure of only $42,000. The work of the California stations this year has been chiefly confined to the propagation of the commercial salmon and to two varieties of the trout. Over 40,000,000 eggs have been distributed from these stations. From the five Oregon stations on the Columbia River, 20,000,000 fry have been planted in the Pacific Coast streams. In the Rocky Mountain region various varieties of the trout were propagated; 60,000,000 fry being distributed. In the middle section of the United States trout, black bass and crappie were distributed in large numbers. From the stations on the Great Lakes where the white fish, lake trout, perch, etc., are collected, no less than 750,000,000 eggs of all kinds were taken and 500,000,000 fry propagated. At the shad stations on the Eastern Coast 300,000,000 shad eggs were collected and 230,000,000 fry planted. In Massachusetts there are two of the largest American fish culture stations in the world; here over 300,000,000 cod eggs were collected, and from 150,000,000 to 200,000,000 fry distributed; over 100,000,000 lobster eggs have been taken, and it is expected that 500,000,000 will be taken before the close of the season.

A MILLION DOLLARS FOR A PATENT.

The president of a large telephone system has offered to pay a million dollars for a telephone repeater which would be as efficient in telephony as the telegraph repeater is in telegraphy. From the earliest days of the telephone to the present time inventors have sought to make such repeaters, and as early as 1878 it was thought that the problem had been solved. It is probable that if such a plan is invented, the experiments leading up to it will be along entirely new lines, for already a large number of trained telephone inventors have tried their hands at it and have failed.

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PAINTING THE FLAGSTAFFS OF TALL BUILDINGS.

The flagstaffs which seem to be an indispensable part of the modern office building often extend to an extraordinary height above the street level. The tallest in the city are those which have been erected above the domes, at the top of the two towers on the Broadway façade of the Park Row building, a description of which appeared in the SCIENTIFIC AMERICAN of December 24, 1898. The top of the dome is 390 feet above the sidewalk, and the trucks of the flagstaffs, which are 57 feet in length, are therefore about 450 feet above the street level.

A few days ago the foot passengers down Broadway, and across the City Hall Park, were watching with great interest the figure of a man who was engaged in painting these lofty poles, and the question naturally arose as to how this perilous work was done. The answer will be found in the accompanying engraving, which shows one of these aerial artists at work. His climbing apparatus is one of the very simplest kind, and consists of two short lengths of rope, each of which is provided with a slip noose which encircles the flagstaff. The upper rope carries an ordinary "bo'sun's chair"—a plain piece of board which forms a seat astride of which the painter sits—and the lower rope ends in a simple foot-stirrup. In climbing the pole, the weight is first thrown on the foot-stirrup, thereby releasing the noose of the upper rope, which is then slid up the pole. The weight is now thrown on the seat, and the stirrup noose being released of weight is drawn a few inches up the pole. By thus throwing the weight alternately on either rope and slacking the other, the painter is enabled to climb to the top of the pole. The painting is done from the top downward; the order of slipping the ropes being, of course, now reversed. Underneath one end of the seat is hung the paint pot, and a dab of putty for filling up cracks and knot holes is stuck conveniently upon the same end of the seat.

Weight carried by stirrup. Weight carried on chair.

HOW FLAGSTAFFS ARE PAINTED.

A NEW METHOD OF INSTRUCTING AND EXAMINING TRAINMEN.

The executives of the most progressive railroads throughout the country are continually devising means to impress upon the employes of the roads the exact meaning of train rules as applied to the various pieces of apparatus that form an important part in the successful operation of the modern railroad.

No scheme has perhaps proved so successful on the Cincinnati Southern road as the method recently devised by Superintendent W. J. Murphy.

The magic lantern has been used with much success by lecturers for bringing before the public that which word painting cannot convey. It has been used for years in our best educational institutions for representing scientific truths, and there is no particular reason why the use of the stereopticon should not prove highly efficient in the instruction and examination of railway employes. While the plan of using models of signals as heretofore employed by the Cincinnati Southern was very satisfactory, it was open to improvement. But one great objection can be offered to their use. A signal is always used on a road to serve a particular purpose at a special place, and therefore there are many applications that can be represented only by taking the trainmen to those particular locations and allowing them to see the exact purpose of the signal. It follows that in order to know whether trainmen are perfectly conversant with the meaning of all signals along the road, they should be called upon to explain the purposes of each signal in its direct relation to all its surroundings. This cannot conveniently be done by taking the men to the exact location of every signal, but the same thing may be accomplished by making lantern slides of all kinds of apparatus, signals, tracks, etc., and presenting these with their actual local surroundings to the trainmen who are to be instructed or examined.

The examining room at Lexington, Kentucky, has been equipped, not only with models and such appliances as are placed in the hands of the trainmen for the moving of trains safely, but an electrical stereopticon has been provided, together with a large number of slides representing equipment on the road. The trainmen are required, not only to familiarize themselves with the rules in the abstract, but they must know the purpose and meaning of every signal and piece of apparatus along the line of the road in question. The men are practically carried over the road by a series of lantern slides projected on canvas, and the examiner is able to determine very satisfactorily as to the fitness of men for the positions which they hold, or to which they aspire.

The use of the magic lantern has demonstrated that it is possible for trainmen to know the meaning of the various positions of all kinds of signals, and to recite glibly what should be done under certain conditions, and yet to be absolutely deficient in the knowledge of what the signal means when it appears in combination with some other. The applications of the lantern are so varied that there is scarcely a phase of railroad work that could not be handled effectively. It is an appliance by which you can bring to the examining room all the apparatus, equipment, and, in fact, the road itself, and all the merits and defects can be discussed accurately and exhaustively.

Our illustration No. 3 represents what is called an electric disk block signal. The color indicated in the small central disk is white. A white signal in connection with the operation of a railroad always means that the train may proceed, but in this case, the rules make it necessary for the train, when running onto a white signal, as indicated by the signal 100¾, to stop, unless the signal changes from white to red in the presence of the engineer. In other words, a stationary white signal means just as much danger to the engineer in this case as a stationary red signal.

Red is the danger position of the same signal, which means stop, except, as previously stated, when it changes from white to red upon a train entering the block limit.

Illustration No. 1 represents what is called a semaphore signal. It is used in connection with interlocking apparatus and worked from the tower shown on the photograph. The upper arm always governs the main or most important track. When this arm is in a horizontal position, trains on the main track would have to come to a stop and not proceed until the arm assumes the oblique position, as indicated by the lower arm. The lower arm governs a track of less importance than the main track and is operated in the same way, so that with the signals as here represented a train on the main track would have to stop, and a train on the siding could proceed.

The second illustration represents a scheduled train; that is, a train shown on the time table. The red signals on the pilot of the engine indicate to the railroad fraternity that the engine is backing up at night. The green lights also indicate that the engine is moving at night and that it is to be followed by another train on the same schedule having equally the same rights. The green flags indicate in the day time what the green lights do at night. If the engine or train were going forward, instead of backward, as indicated in this photograph, there would be no lights where the red lights are shown here, but those red lights would be transferred to the rear of the train, so that these symbols, or signals, indicate quickly to the railroad man just what kind of a train it is—whether it is backing up or going forward, whether it is being followed by another section or not.

A regular scheduled passenger train carries by day green or classification flags on the front of the engine, which indicates that

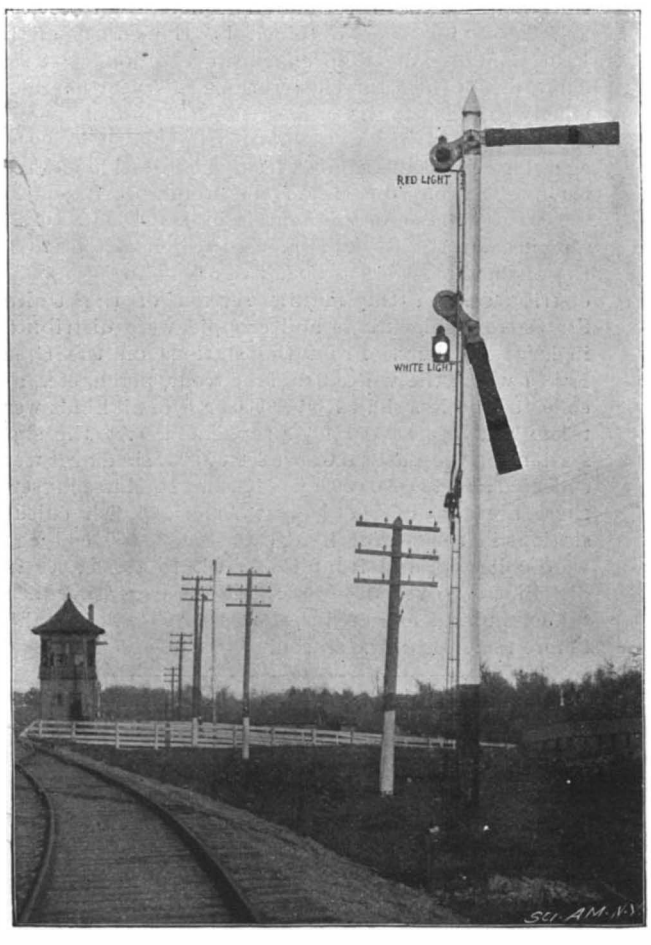

Fig. 1.—SEMAPHORE SIGNAL.
Main line closed, local open.

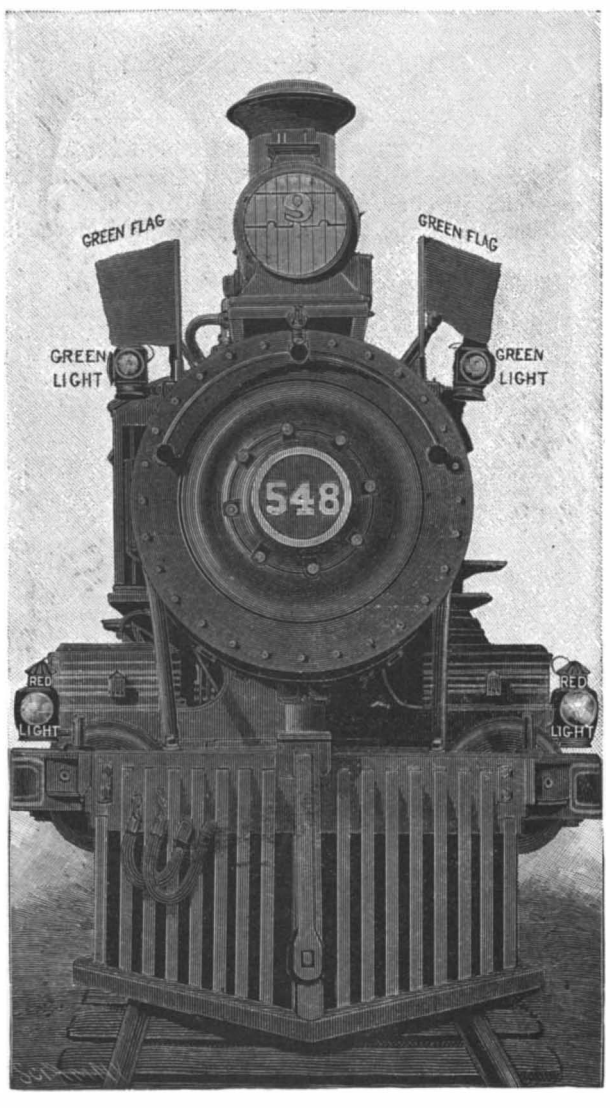

Fig. 2.—TRAIN SIGNALS ON ENGINE.
Schedule train backing up at night.

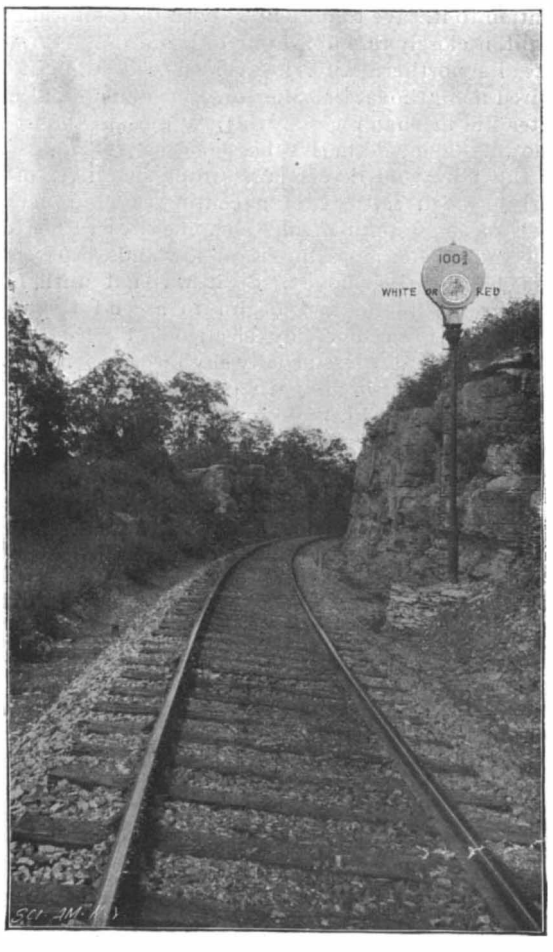

Fig. 3.—ELECTRIC DISK BLOCK SIGNAL.
Train may proceed.

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the train is to be followed by another train on the same schedule with exactly the same rights. Two green flags are carried on the rear or last car to indicate that that is the last car in the train; in other words, that the train is complete. Should the green flags be not shown on the rear car of the train, it would indicate to the railroad man that the train had parted, and that there was only a part of the train together in the front portion, a car or two probably having been lost, which often happens by reason of the coupling breaking or the automatic coupling unlocking. This seldom occurs with a passenger train, but it is a daily occurrence with a freight train.

MODELS OF SOME OF THE EXTINCT LIZARDS OF WESTERN NORTH AMERICA.

BY E. O. HOVEY.

Among the new specimens on exhibition in the American Museum of Natural History in this city, in the department of Vertebrate Palæontology, are recently discovered fossils, as well as models and water color paintings to illustrate the supposed appearance of the great lizards which lived in Western North America in Permian, Jurassic and Cretaceous time. Through the kindness of Prof. H. F. Osborn, the curator of the department, we are enabled to present our readers with photographs of some of these models and of one of the great skeletons as it lay in the rock from which it was excavated and the facts concerning them.

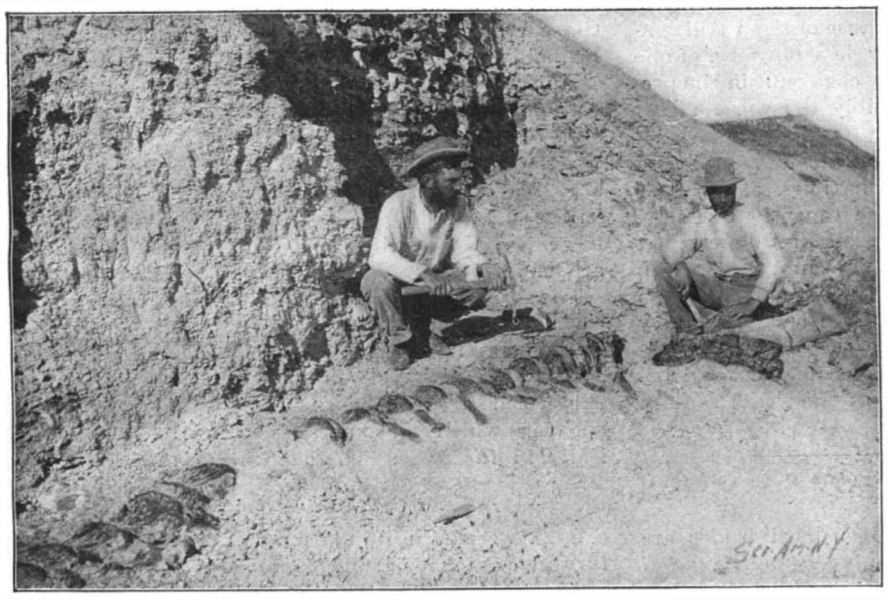

Fig. 1.—FOSSIL BONES IN MATRIX.

This department of the museum was established in the spring of 1891 for the purpose of procuring a representative collection of the fossil vertebrates from the successive geological horizons of the western part of this country for exhibition, research and publication. Every year since then expeditions have been sent out, mainly to the great Tertiary lake basins of the Rocky Mountain region, and an immense amount of material has been gotten together, much of which is now on exhibition in the museum. In the summer of 1897 the expeditions had extraordinary success, one of the parties making one of the most important discoveries ever made in vertebrate palæontology. This party, under the leadership of Dr. J. L. Wortman, was opening a quarry in southern Wyoming for obtaining specimens of the oldest form of mammals when it made the discovery, first of one and afterward of another reptile skeleton of enormous size, and in a remarkably good state of preservation. Fig. 1 is made from a photograph of the bones as they lay in their matrix before they were removed for transportation, giving some idea of the manner of working this form of excavation. The greatest care must be exercised not to injure the surface of the bones with rough implements. After the fossils have been excavated they are carefully wrapped in burlaps and plaster of Paris, to prevent, as far as possible, their crumbling to pieces on drying and to enable them to bear in safety the long journey to the museum. These bones are wonderfully well preserved, and show that the animals to which they belong must have been between fifty and seventy feet in length. The parts represented were the tail vertebræ and the limb bones.

Fig. 2.—AGATHAUMUS SPHENOCERUS.

Many attempts have been made to clothe the skeletons of extinct vertebrates with flesh and blood, but the most life-like of all thus far have been the water-color paintings which Mr. Charles Knight has prepared under supervision of Prof. Osborn and Dr. Wortman. Lately Mr. Knight has turned his attention, under the same supervision, with many suggestions from the late Prof. Cope, to the preparation of a series of models on a reduced scale of some of these animals. The results of some of this work are shown in Figs. 2 to 5, which are from photographs of the models. These models are based upon published restorations of the skeletons and upon the study of the best material to be found in the collections of the American Museum, Princeton University and the late Prof. Cope. This material gives definite knowledge or inference upon the form and proportions of body and limbs, the shape and character of the head and the position of the sense-organs. The character of the skin is in some cases known to some extent, but in others it has been based upon that of the nearest related living species.

Agathaumus (Fig. 2) was a large, heavily armored dinosaur, or giant lizard, from the Upper Cretaceous beds of Western America, having one large and two comparatively small horns for weapons of attack. The animal was about twenty-five feet long, its feet were provided with hoofs, and the limbs were more symmetrically developed than they were in some other dinosaurs. It lived upon herbaceous food.

Hadrosaurus (Fig. 3) was a great lizard, thirty-eight feet long and provided with a long neck, flattened bill like that of a duck, weak teeth, small fore legs and heavy hind legs and tail. It probably was at home both on the land and in the water and fed upon soft water plants or small mud-loving animals. The animal

Fig. 3.—HADROSAURUS MIRABILIS.

was covered with a thick hide like that of a rhinoceros, as is known from specimens in the Cope collection in the museum. Its skeleton is found in the Laramie Cretaceous beds of the West.

Fig. 4 represents two individuals of the genus Megalosaurus, Prof. Cope thinking that these animals were great jumpers and fighters. This was the first dinosaur described by Prof. Cope and was from the Cretaceous beds of New Jersey. It was a carnivorous animal, and, although it did not attain the enormous size of some of the herbivorous dinosaurs, it was a formidable creature, being light and active and well armed for attack. Some of the bones were hollow like those of birds. The animal was about fifteen feet long, with about eight feet of this length in the tail. The long hind legs and the strong tail remind one of the kangaroo, and it may even have resembled that animal in getting over the ground by means of leaps, instead of by walking or running, and in using its powerful hind feet, which were armed with heavy claws, in attacking its enemies or its prey.

Naosaurus (Fig. 5) was one of the more primitive reptiles, and its remains are found in the Permian rocks of Texas. It was evidently a highly specialized side branch of the order of reptiles, but the precise use of the enormously rigid fin along its back is not known. Prof. Cope humorously suggested that this fin might have been useful as a sail. It was, perhaps, chiefly ornamental. Different species of this lizard were from three to ten feet in length, and some of them had even longer dorsal fins than the one shown in the model.

Practical Lectures on the Treatment of Animals.

Perhaps never in the history of illustrated lectures was one given amid such queer surroundings as the one which was delivered on June 22, by Mrs. Myles Standish, president of "Our Animal Protective League," an association which was founded a short time ago, and which has for its object the teaching of those who have to deal with animals, and especially with horses, that kindness to our dumb dependents is not only a duty, but it also pays. Some of the New York east side drivers were informed of the organization of the society and its object, and they invited members of the society to visit them, and the drivers offered to furnish the expense of the stereopticon and also to provide accommodation for the lecturers. A large stable and stable-yard were secured and were thoroughly cleaned in honor of the occasion. An audience which numbered about 700 made its way between two rows of trucks and carts to the yard in the rear. Here the vehicles were stood on end with the exception of a truck which rested on its wheels, which served as a lecture platform. A sheet was nailed on the wall of a building and 150 views were projected, the talk being given by Mrs. Standish and other members of the society. They told them the proper way of harnessing and treating horses and showed that cruelty was very often caused by ignorance. Views of the horses of the fire, police, and street cleaning departments were shown. The remarks of the lecturers were listened to with great attention by the drivers, and it is thought that the meeting will be productive of great good. Work of this kind is of the most practical nature and deserves the warm support of all who love animals.

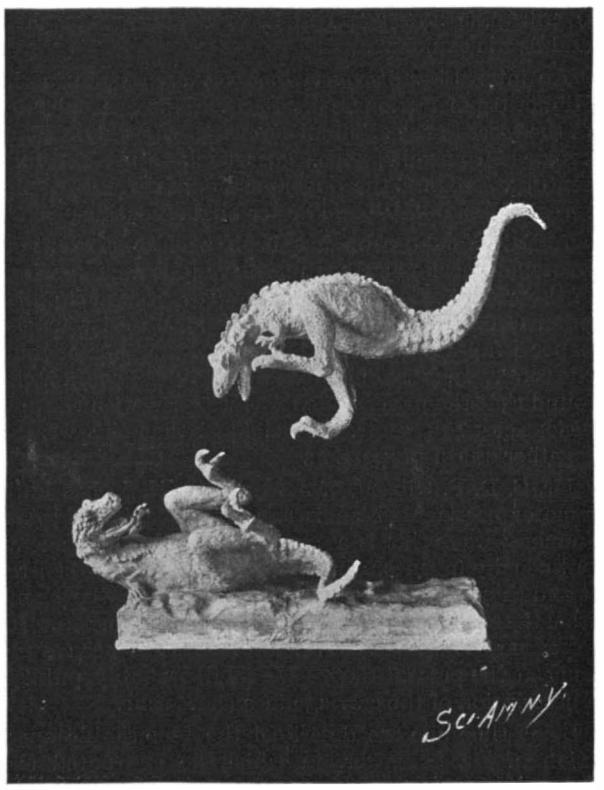

Fig. 4.—MEGALOSAURUS AQUILUNGIUS.

A CLASS for the instruction of hospital-corps men in preparing food for the sick has been organized at the Washington Arsenal, according to The Boston Cooking School Magazine. The work is to be carried on under military regulations, and the aim is to provide a corps of men who can provide for the sick such food as is available. The plan involves also the establishment of a school or schools for army cooks to be conducted by regular officers at some convenient recruiting station.

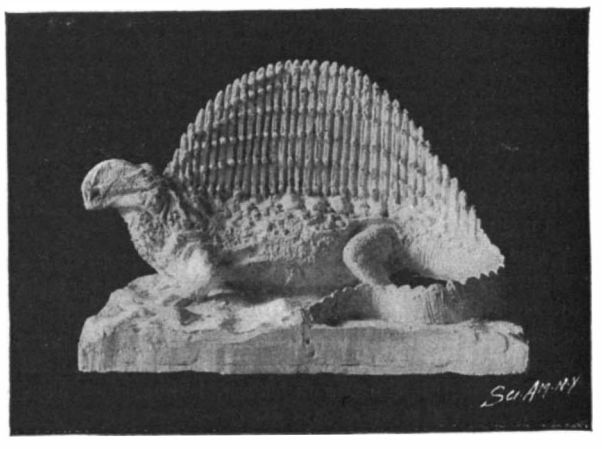

Fig. 5.—NAOSAURUS CLAVIGER.

TELEGRAPHIC communication will be established between the Scottish islands of Muck, Egg, Canna and Rum. They are all to be connected with the mainland and with the Isle of Skye.

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Science Notes.

A small exhibition will be held in Belgium under the name of "Electricité à la Maison."

In Boston, policemen in citizens' clothes are mounted on bicycles and patrol the different streets of the Back Bay district. They make practically no noise and would be considered by thieves to be ordinary wheelmen returning from some of the fine bicycle runs in the environs.

The Duke of Abruzzi sailed, on June 12, for Barents Sea and Franz Josef Land. Walter Wellman has a year's start of the Italian explorer. The Smith Sound or American route, which is chosen by Peary and Sverdrup, is now again in favor among geographers and Arctic explorers.

An interesting discovery has just been made in the Bibliothèque Nationale at Paris. This is a calendar of the cases in the criminal court known as the Chambre de la Tournalle, which goes back to the fifteenth century. Among the papers are official notes of the arrest of Joan of Arc and of her final execution.

A Baltimorean who has been a close student of household economics has recently made a comparison of the weight of paper with the weight of food supplies purchased. In one day's purchase it is said that the paper wrapping amounted to about ten per cent of the total. In a list of supplies costing about $1.40, he found that the paper which was weighed with the provisions cost 14¾ cents. He claimed that this was altogether out of proportion.

Mr. C. D. P. Gibson, of Jersey City, N. J., has built a motor carriage which is run by carbonic acid gas. In many ways this is a most alluring motive agent, but usually inventors have not been able to control it and they could not prevent the valves of the agent from freezing, owing to its too rapid expansion. Its expense was also against it; the latter has been overcome at the present time. We shall probably publish a description of the carriage in a short time.

Some time ago we described the remarkable operation of Dr. Schlatter, in which he extirpated the stomach of a female patient. It is interesting to know that she lived fourteen months after the operation and that there was no difficulty in keeping up the nutrition of the patient. The food taken passed directly from the esophagus into the intestines, and the intestinal digestion was sufficient to satisfy her wants. This was shown by the long continuance of her life after the operation.

The United States Geological Survey has recently published a valuable map of New York city and vicinity. It is a revised edition. The original survey was made ten years ago, and an edition of the map was issued at that time, but the territory covered by the map was considerably different from the territory shown in the new map. Like all the other maps issued by the Survey, it is well adapted for scientific and popular uses and in accordance with the law is sold at the cost of printing.

The Sleep Problem.

In these days of rush and excitement, when the nervous system is too often stretched to its utmost tension, and when neurasthenia is rampant everywhere, the question of rest and sleep must be considered. The mode of living has so altered, even within the past thirty years, and especially in this country, that the sleep problem is the matter of the first importance. This being the case, the fact that little is definitely known as to the cause of sleep is decidedly curious. Sleep—perhaps the most marvelous phenomenon in the world—may rightly be termed a mystery.

But, as with everything to which by long use we have become accustomed, we regard it with indifference. In some journals and magazines in this country and in Great Britain instructive articles have been of late contributed in regard to sleep. Dr. Andrew Wilson, in the April issue of Harper's Magazine, takes the popular view that it is in the brain cells that we shall probably find such explanation of sleep as science can afford. Madam de Manaceine, who has in an essay published some few months ago collected and presented in an attractive form the principal facts dealing with the causation of sleep, says:

"The truth is that although the problems of sleep have exercised some of the greatest intellects of ancient and modern lines from Aristotle downward, all that we really know of sleep is due to the labors of a comparatively small number of workers." The vasomotor theory of sleep is the one most widely accepted. Cerebral anæmia is one of the most potent predisposing factors. Fluger contends that carbonic acid plays a very important part in the causation of sleep. Nerve histologists have put forward the principal theories with regard to sleep, of which those advanced by Howell of Johns Hopkins have perhaps obtained the most credence.

Leonard Hill thus summarizes the facts which are known concerning sleep: 1. Respiration. (a) The number per minute remains unaltered, the movement becomes shallow and thoracic in type; (b) the amount of inspired air per minute is lessened by from one-half to two-thirds; (c) the output of carbonic acid gas is diminished by one-half to two-thirds. 2. Circulation. (a) The blood congests in the limbs; (b) the venous system is engorged; (c) the arterial pressure falls; (d) the pulse rate diminishes; and (e) the velocity of blood flow decreases. 3. Temperature. The temperature falls during the night. The production of heat is estimated to diminish by from half to two-thirds. 4. Nervous system. (a) The blood-flow through the brain is diminished; (b) the acidity of the cortex decreases; (c) the excitability of consciousness to external stimuli steadily decreases during the first one to two hours of sound sleep. After that period the excitability rapidly becomes almost as great as it is toward the end of sleep; and (d) consciousness alone seems to be abrogated during sleep. The nerves and the special senses continue to transmit impulses and produce reflex movements. Cerebral anæmia is the theory which has the most wide acceptance, but as Leonard Hill remarks, such speculations do not carry us far, and the causation of sleep must still be regarded as metaphysical. While, however, the cause of sleep still continues to be enveloped in more or less mystery, of one truth we are much too frequently cognizant in the present age—that of insomnia, possibly the worst misery to be imagined.

Highly wrought nervous organizations, produced by the high pressure living of our times, are in this country rather the rule than the exception. Therefore the absolute need for a period of repose spent among healthy, invigorating surroundings, which should be a sine qua non with the fagged-out brain workers of our cities. This question is undoubtedly one of the most serious confronting the rising generation who dwell in the busy centers of trade, and becomes more and more menacing as the years roll on. —The Medical Record.

The Rare Woods of Our Philippine Possessions.

BY GEORGE E. WALSH.

Many valuable and little known hard woods are found growing wild in the Philippine Islands, some of which will become important articles of export when better known. The tropical nature of the climate, and the wonderful fertility of the soil, make the growth of these woods merely a matter of planting and time for them to develop and mature. The sapan wood is probably the best known of the merchantable timber, but this product does not equal the sapan wood of Pernambuco. It is a short and unattractive tree, and the wood is generally hard, heavy, crooked, and full of knots. When first cut it is white, but it assumes a deep red color on exposure to the air, and is susceptible of a very fine polish. The heart of the branch contains coloring matter, which is extracted by boiling, and is known in the trade as "false crimson." It is not as good or permanent as cochineal dye.

There are some fifty varieties of hard woods found in the islands, but many of them do not grow to a sufficient size to be of commercial use, as squared logs cannot be cut from them. A variety of Herculia ambiformis called dungon is sometimes sold as ironwood. It is a hard, durable wood, and is much used on the islands where great strength is required. It is used for the keels of the native boats, and its great durability partly accounts for the strength and staunchness of these craft. In Manila it is employed for buildings to support the roofs or other heavy weights. It cannot be procured in sufficient lengths to answer many purposes, as it rarely grows higher than fifty feet, giving logs up to 20 inches square.

The tropical nature of the water surrounding the islands makes the danger to wooden ships and piles from the sea worms (Teredo navalis) and the white ants (termes) very great, and it has required years to construct works that will last. There are at least two different woods which successfully resist these injurious insects. The molave (Vitex geniculata) not only resists the attacks of both insects, but also the destructive action of the climate. Consequently this wood has great local value. It is used in marine work where the teredo is likely to attack it, and also underground where the soil is wet and soggy. It is frequently employed for the frames of vessels, and its peculiar tendency to grow crooked enables ship-builders to secure good sticks already bent for them. It will also prove of great value for railroad sleepers, as its imperviousness makes it remarkably long-lived. The natives call the wood the "Queen of the Woods."

Another good wood that resists the Teredo navalis and the effects of the climate is the antipolo (Artocarpus incisa). In other respects this is a better wood than the first. For instance, when it has been properly seasoned it never warps. It is remarkably strong, and resists great lateral pressure. It is highly prized by shipbuilders, who use it for the outside planking of their ships and for keels. Although strong, this wood is comparatively light.

Two woods that are used extensively for piling in both salt and fresh water are the aranga (Homalium) and betis (Azaola). The first produces logs 75 feet in length and 24 inches square. It is a favorite wood for sea piling and all rough marine work. The second wood gives logs about 60 feet in length and 20 inches square. It is a better class of wood than the first, and besides being employed for sea piling, piers, and wharves, it enters quite largely into the construction of ships.

A fine wood that is employed extensively in house building is the Mimosa acle, which gives logs 32 feet long. This wood is very hard to burn, and houses built of it do not succumb to flames nearly as quickly as other woods. Its power of resisting fire is almost equal to bricks. For this reason house-builders use considerable of it. It is also very strong and durable, and susceptible to a high polish.

A strong, tough and elastic wood comes from the batitinan (Lagerstrœmia batitinan) tree. It has a variety of uses, from making furniture to planking the sides of ships. It makes a fine substitute for mahogany or black walnut for cabinet work. It is even stronger than the Chinese teak wood, and it could be used wherever this wood is now employed. When properly seasoned, it stands the climate very well, but it is not proof against the sea worms or the climate when buried underground. Probably one of the hardest woods is the bansalague (Mimusops elengi. Lin.), which is commonly known in Europe as the bullet-tree wood. Its grain is very close and compact, making it excellent for turning purposes. The wood is so tough that it can be shaped like a nail and driven into other woods with a mallet. In the ship-building yards at Manila it is employed as treenails. Nearly all of the local ax and tool handles are made of this wood.

The mahogany of the Philippines is the narra (Pterocarpus palidus santalinus), which gives logs up to 35 feet long and 26 inches square. It has a rather open grain, but it polishes well and is very prettily marked. The wood from different trees presents a variety of colorings which can sometimes be arranged very artistically in furniture. The markings run from a light straw color to a clear blood red. It has been exported to London for many years, where it is used in fine cabinet work. In Manila most of the best grades of furniture are made from this wood. Of the same order as the mahogany is a cedar called botanically Cedrela odorata, but known in the islands as calantas. It is a very handsome wood when polished, and it is used for inside finishing in the houses. But its principal use in a commercial way is for making cigar boxes. It is not equal for this purpose to the Spanish cedar used for boxing Havana cigars, but it is a fair substitute, and about the only satisfactory one found in the Philippine archipelago. It can be obtained in pretty fair logs, some running up as high as 40 feet in length and 35 inches square.

A peculiar-looking wood for cabinet and furniture manufacturing is the camagon or mabolo, a variety of Diospyros philoshantera, and it is used quite extensively for the purposes it is adapted for. It takes an excellent polish, and when finished vivid black with yellow streaks are the predominating colors. This combination makes very effective work for certain kinds of furniture. It is a close-grained and brittle wood, but rarely comes in lengths over 9 feet. Another good furniture wood, and a substitute for black walnut, is the dinglas (Eugenia sp.), which is hard, strong and durable. Its markings are good, and it polishes beautifully. Ebony is found in limited quantities, but it can hardly be called an important commercial wood. Dipterocarpus guijo is the wood used by the wheelwrights in Manila. Both carriage wheels and the shafts are usually made of this wood. It is naturally very tough and elastic—two necessary qualities for carriage building in any country. A great deal of this wood is exported to Hong Kong, where it is employed for flooring the wharf decks. Mangachapuy is a strong elastic wood that equals teak for withstanding the climate. In ship-building it furnishes the masts and spars, and it holds high favor among those who have used it. When exposed to the hot sun and rains, which is very hard on all woods in such a climate, it holds its own with the best that can be produced. It must be seasoned properly for the purpose, however, or will show signs of decay much earlier.

Many of the trees of the Philippines produce fragrant sap that is used for different purposes. Some of them yield a sap that is very valuable for polishing the smooth surfaces of other woods. Thus the sap of the ipil tree gives a glazed polish or covering that is very effective. In the hands of an expert it is sometimes put on so successfully that it resembles the varnish used on japan-ware. Hot weather affects the polish made by the sap more than cold weather. The wood of the supa tree produces an oil which is extracted for commercial uses, and the wood then used for house-building. The apiton yields a gum which the natives collect for incense burning. It has an agreeable odor.

PROF. REGINALD A. FESSENDEN, of the Western University of Pennsylvania, has invented a telescope which it is said will tend to lessen the efficiency of smokeless powder in warfare by locating the flash when the powder is discharged. The War Department will make a test of the instrument before the examining board.

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Miscellaneous Notes and Receipts.

Hardening Powder for Steel Tools.—The Zeitschrift fuer Maschinen bau und Schlosserei is authority for the following process: Powdered stag's hoof, 500 parts; Peruvian bark, 500 parts; cooking salt, 250 parts; refined saltpeter, 150 parts; potassium cyanide, 150 parts; all powdered well, mixed and made into a paste with 1,000 parts of black soap. The tools are made red hot, the powder is applied, and the tools are next hardened. For tempering the following lead baths are recommended: Tin 4 parts, lead 7 parts; tin 4 parts, lead 8 parts; tin 4 parts, lead 14 parts; tin 4 parts, lead 19 parts; tin 4 parts, lead 48 parts; tin 2 parts, lead 50 parts.

Gold and Silver Bronze on Leather.—In order to render bronzes on leather durable, it must first be saturated with a solution of sugar of lead or cupric acetate, and then exposed to the action of hydrogen sulphide. The bronzing may be done by applying the solution with the sponge or by the galvanic process. In the former case the following solutions are used. For gold: Gold chloride solution (containing 15 grammes of gold chloride), 21 grammes; soda solution (40 grammes of soda to 1 liter), ½ liter; glycerine, 15 grammes. For silver: Water, 10 liters; silver nitrate, 100 grammes; ammonia, 65 grammes; tartaric acid, 15 grammes; or water, 10 liters; glucose, 100 grammes; silver nitrate, 10 grammes (?) For nickel: Nickel nitrate, 400 grammes; ammonia, 400 grammes; water, 15 liters; Glauber's salt, 5 kilos. For cobalt: Water, 1,000 liters; cobalt-ammonium sulphate, 1 liter.—Schuh und Leder, 1899, No. 7, 35.

To Transfer Pictures on Wood.—For transferring pictures (copper prints, etc.) to wood, it is best to choose soft kinds of wood, such as poplar, linden, or maple. The surface is rubbed smooth with bleached linseed oil and warmed over a coal fire. Then the surface is coated three times with varnish from sandarac, 30 grammes; shellac, 15 grammes; turpentine, 15 grammes; and alcohol (90 per cent), 375 grammes. This varnish may be colored as desired—red with dragon's blood, or yellow with curcuma. The copper print, etc., is now soaked thoroughly in salt water, then laid on blotting paper so that the moisture is drawn off and the picture only remains damp. Next, coat the wooden surface again with varnish, likewise the print, and lay the latter on the wood with the printed side; lay on a piece of flannel and on the flannel a smooth, warmed piece of wood, and squeeze the whole firmly together in a screw clamp. After a few hours the work is dry and the back of the paper is carefully rubbed off with a linen rag saturated with water. The transferred picture is rubbed lightly with linseed oil and coated a few more times with the varnish.—Maler Zeitung.

Indelible Red Ink.—The Hannoversche Gewerbeblatt gives a formula for the production of a red ink, which is said to excel in great resistance to washing and bleaching mediums. This is the recipe: Prepare three solutions. 1. Soda, 3 parts; gum arabic, 3 parts; water, 12 parts. 2. Platinum chloride, 1 part; distilled water, 24 parts. 3. Zinc chloride, 1 part; distilled water, 4 parts.

The spot where the writing is to be applied is moistened with solution 1, and rubbed with a warm iron. Now put on the letters by means of a pen or pencil dipped in solution 2. After this has become dry moisten the place with solution 3.

For linen goods the following process is also very useful: White of egg is dissolved in an equal quantity of water and stirred with a glass rod until the solution froths, when it is filtered through a linen cloth. The filtrate is made into a thick paste with finely ground cochineal red. With this mass the monogram, etc., may be applied on the linen, using a drawing pen or quill. The place is then treated from the back with a hot flat-iron until the albumen has coagulated.—Farben Zeitung.

Production of Tarsia Material.—This new process makes it possible to produce the insertions necessary in the manufacture of tarsia material, in large quantities, by means of ordinary stenciling machines.

As a substance capable of imparting to wood the necessary pliancy without detracting from the color, and without changing the structure of the fiber, an alum solution has been found very valuable, the veneers to be cut in the aforesaid process being saturated with it. The alum combines with the dyestuff in the wood into a lake possessing the same color, so that the shade of the wood is preserved by this treatment, while the other organic constituents of the wood are also kept from decomposition by the admixture of alum. The veneers produced with it show very sharp outlines, and remain entirely free from cracks and warping, even if stored for a long time, because the alum does not change the structure of the wood, and is not sufficiently hygroscopic to absorb water when stored, as is the case with the use of other salts, such as calcium chloride, which is frequently employed.

When alum was heretofore employed in the wood-working branch, it was merely for the purpose of precipitating on the fiber agents such as logwood, used for staining the wood, the wood fiber being first given the last stain, and then treated with the alum solution, or else shades produced in the wood, such as the one obtained by the use of green vitriol, were moderated by boiling with alum, in consequence of its acid reaction. In the present process the dyeing is not concerned, but merely a peculiar treatment of the wood fiber for the purpose of a simultaneous production of large quantities of veneers of faultless cut and durability.

For carrying out the process the veneering leaves are simply boiled in an alum solution until one has satisfied one's self by a sample that the transformation has taken place. The leaves cut out are then used in the customary manner for inlaying, without any fear of distortion.—Neueste Erfindungen und Erfahrungen.

The Kachin Developer.

SIMULTANEOUS DEVELOPMENT AND FIXATION.

Kachin, about to be put on the market as a developer, is a white crystalline powder easily soluble in water, and does not stain plates, skin, or nails. Its makers recommend the use of sodium sulphite with it as a preservative, and sodium hydrate or sodium carbonate as the accelerator.

Several brands of plates of different speeds were exposed upon a variety of subjects. The exposures varied from half the estimated correct exposure to four times that which would have been sufficient for the subject in hand, the object being to submit the developer to the tests which would be likely to occur in practical work.

After a number of experiments upon correctly exposed plates, during which the constituent parts of the developer were frequently modified, a formula was evolved which gave excellent results with all the plates tested, and which is capable of being easily adjusted either previous to development or while development is proceeding, to correct errors in development within wide limits, and so obtain the best possible results.

STOCK SOLUTIONS.

A—Kachin	120 grains.
Sodium sulphite	1,200 "
Water to make	10 ounces.
B—Sodium hydrate	80 grains.
Water to make	10 ounces.
C—Sodium carbonate	1 ounce.
Water to make	4 ounces.
D—Sodium sulphite	1,200 grains.
Water to make	10 ounces.

For use with correctly exposed subjects, such as ordinary landscapes, in which a fair amount of contrast is required, take—

A solution	160 minims.
B solution	30 "
Water to make	1 ounce.

Each ounce of the mixed developer will contain kachin 4 grains, sodium sulphite 40 grains, and sodium hydrate ½ grain.

This developer will give ample density and contrast without causing any veil upon the edges of the plate without the use of bromide. For a correctly exposed subject, such as portraiture, in which less contrast is required, the developer may be altered as follows:

A solution	80 minims.
B solution	30 "
D solution	80 "
Water to make	1 ounce.

In this developer the proportion of kachin has been reduced to two grains to the ounce, the proportions of the other constituents remaining the same.

When sodium carbonate is preferred to sodium hydrate, twenty minims of the C solution should be substituted for the thirty minims of B, in which case each ounce of developer will contain five grains of sodium carbonate. In cases of under-exposure, where the action of the light has been sufficient to impress detail upon the plate, the following modifications will do all that is possible with any developer in the way of giving strength to the shadows without undue density in the lights.

A solution	80 minims.
B solution	60 "
D solution	80 "
Water to make	1 ounce.

A further addition of sodium hydrate will induce veil over the shadows, but if sodium carbonate is used the amount may be increased to twenty grains (eighty minims of C solution) with advantage.

In all these modifications the proportion of sodium sulphite should remain constant to the ounce of developer. Unless sufficient of the D solution is added to make up the deficiency, the quality of the negative will be impaired. A reduction in the quantity of sodium sulphite may, unless the amount of sodium hydrate is also decreased, lead to a slight veil over the shadows, and if the proportions of both are lessened, there will be difficulty in obtaining density.

A single drop of a ten per cent solution of potassium bromide will slow the action of the developer considerably, so that it is not necessary. In cases of slight over-exposure, all that is necessary is to make an addition to the proportion of kachin from the stock solution, which carries with it an addition to the proportion of sodium sulphite. This with a slight decrease in the amount of sodium hydrate or sodium carbonate at the beginning of the development will keep the shadows clear, and allow sufficient density and contrast to be obtained.

A method of dealing with over-exposure is to take advantage of an attribute peculiar to this developer. Kachin may have sodium hyposulphite added to it in such a quantity that *development and fixation proceed simultaneously.*

This can be done in all cases except when under-exposure is suspected, as it has a tendency to give brilliant results, but this tendency is of great service in case of over-exposure.

For correct exposures the following formula will give admirable results, and will serve as a basis to be modified for other conditions.

E—Stock solution of sodium hyposulphite:

Sodium hyposulphite	1 ounce.
Water to make	2 ounces.

Working solution for simultaneous development and fixation:

A solution	160 minims.
B solution	240 "
E solution	20 "
Water to make	1 ounce.

In using this solution for a correctly exposed plate fixation will have taken place by the time development is complete.

In cases of over-exposure the proportion of B may be reduced to one-half, and when development has proceeded some time, the proportion of hyposulphite may be increased, but in no case should the proportion at the beginning of development be greater than that stated above. When specially soft results are required, the proportion of kachin may be reduced to half with an addition of D solution to make up for the deficiency of sodium sulphite, and B solution may be increased to hasten development.

In addition to the saving of time effected by this method of working, it is possible—after the plate has been some time in the developer, and the image is clearly seen—to increase the amount of light. It is possible to complete the development of the most rapid plates by the light of an unshielded gas flame without grave risk of fog, if a little care is used, but such a proceeding is not to be recommended. A single sheet of orange glass or canary fabric will remove the danger, and allow sufficient light to pass for all purposes. With the increased amount of light, and the removal of the silver bromide during development, the estimation of density becomes a simple matter.

Sodium carbonate cannot be used in the developer in conjunction with hyposulphite. Even when forty grains of sodium carbonate were used to the ounce of developer, the fixation outran development. When the proportion of hyposulphite was reduced to one-half that stated, a curious result took place. Development was extremely slow, and at first it appeared as if no image would be formed, but after an hour's action a positive image was formed strong in the shadows, but with a deposit of semi-opaque white silver in the lights. This deposit was not dissolved when the plate was transferred to the ordinary fixing bath. With fuller knowledge it may be possible to obtain good reversed negatives in this way. The color of the negatives produced by kachin is a good black, free from any tint of blue.

In its power of giving contrasts, gradation, or extreme softness at will, with the entire absence of stain, kachin compares very favorably with pyro.—J. McIntosh in Photography.

What Constitutes a Healthy Man.

One of our medical contemporaries, The Texas Medical News, thus sums up the qualities which constitute a perfectly healthy man. He should have a strong, healthy heart; one not weak from disuse or the excessive use of tobacco, alcohol or other causes; lungs well developed and that expand rhythmically with ample breathing space for health and a surplus for work or disease; muscles well rounded and elastic, made hard and strong by use and carrying, like the camel's hump, reserve energy for trying journeys: nerves, nature's electric wires properly insulated and connected, bringing all the various organs of the body into one perfect system, and all under the control of a brain of just proportions, well balanced and convoluted, not soft from disuse or destroyed for the need of rest; educated for the high duties it was intended to perform, not only to stand guard over and protect the health and life of the individual, but at the same time to furnish feeling and thought and pleasure for the human being. All of these organs, when properly constructed and adjusted and perfect in every detail, go to make up a healthy individual and one possessing within himself a power of resistance not easily overcome by disease-producing organisms.

DR. TARLETON H. BEAN has been appointed Director of Forestry and Fisheries of the United States Commission to the Paris Exposition of 1900. The appointment was made by Commissioner-General Peck.

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COMPLETE LOSS OF THE STEAMSHIP "PARIS."

We have refrained from giving any lengthy notice of the loss of the steamship "Paris" of the American line until it was known definitely whether there were any possibility of saving this unfortunate vessel. It is now learned that the officials of the American line have abandoned all hope of floating the ship and have turned her over to the underwriters. It is possible that the latter will make a final effort to recover this costly vessel before leaving her to be broken up by the heavy seas which break upon the coast of Cornwall.

The details of the stranding of the "Paris" are too well known to our readers to need any lengthy repetition. She left Southampton shortly after noon on Saturday, May 20, and in accordance with arrangements recently made by the American line, proceeded across the channel to Cherbourg, where she took on an additional fifty passengers. She left that port at six o'clock in the evening of the same day for New York, and soon after one o'clock on Sunday morning, just before high tide and in rather thick weather, she ran ashore on the Cornish coast off Lowlands Point, which is situated about nine miles from the town of Falmouth and not many hundred yards distant from the fatal "Manacles" rocks. The "Paris" has met her fate therefore almost on the identical spot which caused the fatal wreck of the "Mohegan" of last October, when out of fifty-three passengers and a crew of ninety-eight, all but fifty were lost.

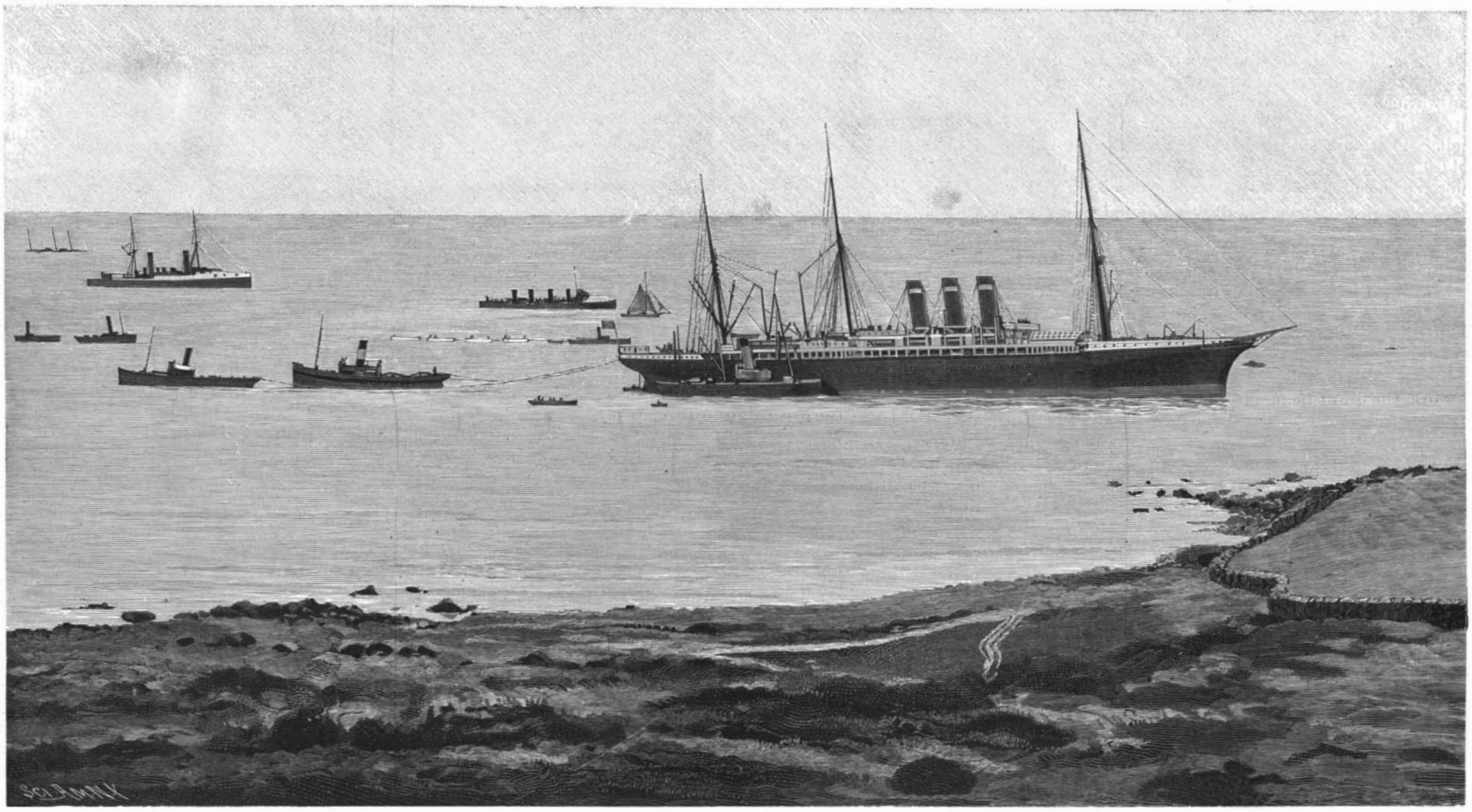
By reference to our engraving of the scene of the wreck, it will be seen that the "Paris" must have passed in close proximity to the "Manacles," which lie a few hundred yards astern of the vessel and are still marked by the projecting masts of the "Mohegan." It is probable that she was running at a fairly high rate of speed, and as the vessel is capable of 20 to 21 knots an hour when doing her best, and when loaded has a displacement of over 16,000 tons, it can be understood with what terrific impact she must have run upon the rocks. At the point where she struck is a ledge or reef extending out from the shore, and the impetus of the great ship was sufficient to cause her to mount the ledge for about 250 feet of her length. The rocks cut through her double bottom and destroyed the integrity of the bulkheads, the first four or five watertight compartments being penetrated.

From the first it must have been evident to all practical men that the ship was doomed, nevertheless, everything possible was done to save her. In response to the call for assistance, several tugs from Falmouth quickly responded, and at daybreak a requisition was sent to the navy authorities asking them to send assistance to the stranded ship. The request was immediately complied with, and the gunboat "Antelope" started at once for the wreck, and was followed by a torpedo boat destroyer and one or two other government vessels. The passengers were safely taken ashore by the small boats of the "Paris," and not a life was lost. Our illustration is made from a photograph which was taken the next morning, when an effort was being made to tow the vessel off the ledge. The torpedo boat destroyer is lying off the port quarter of the "Paris," with the gunboat "Antelope" a hundred yards astern.

As to the direct cause of the disaster, the public is as little informed to-day as at the time it happened, more than a month ago. The fact that the wreck occurred so close to that of the "Mohegan" has started the old suggestions of local magnetic attraction acting on the compass, cross currents in the channel, etc., which were offered to explain the "Mohegan" disaster. The impression is gaining ground, however, that the course had been wrongly laid. If this is so, it must be regarded as one of those accidents which may always occur where safety depends so largely upon the "human element" as it does in navigation. Capt. Watkins is one of the oldest and most experienced navigators on the Atlantic route, and we know from personal inspection of the regulations governing the officers and navigation of the ships of the American line that the greatest possible care is taken to guard against error.

The "Paris" was at one time the most notable of the fast transatlantic liners. She and her sister ship, the "New York," were built in 1889 and were the first large passenger steamers to be fitted with twin screws and achieve a speed of over 20 knots an hour. She is 525 feet long, has a tonnage of 10,795 tons, and her engines indicate 20,000 horse power. In her maiden trip to New York she broke the record from Queenstown and created a record of 5 days 15 hours and 58 minutes; her best average for one day was 21·02 knots an hour. On March 5, 1890, when 216 miles west of Fastnet Rock, Ireland, one of her engines collapsed, and as a result both engine rooms were flooded, and for three days she drifted with 2,000 tons of water in her engine room compartments. She was finally picked up and towed to Queenstown. During the Spanish war she served, under the name of the "Yale," as a scout auxiliary cruiser, and under the command of Captain Wise she captured the "Rita," a blockade runner, and was of great service as a transport, scout, and dispatch boat.

Manacles Rocks and Wreck of "Mohegan."



Gunboat. Torpedo Boat Destroyer. Lowlands Point.

STEAMSHIP "PARIS" (NOW ABANDONED TO THE UNDERWRITERS) ON THE ROCKS OF THE CORNISH COAST.

How to Get Rich.

The Book-keeper, a useful magazine devoted to the science and practice of book-keeping, published at Detroit, Mich., has been asked by a subscriber how to get rich. Others, too modest to ask, are equally interested to know. In answer to his correspondent the editor quotes the sayings of some of our most prospered citizens.

What the expressive language of the day designates as a "wise guy" used to advertise a recipe for this very thing, charging a dollar, and responding thus by return mail: "Work like the devil and don't spend a cent." Personally, we are working on the problem teeth and toenails, but at this stage of the game we can offer nothing better than theories, and you can get those in carload lots for nothing. The only positively reliable information that we can give up to date is that it is a mighty tough proposition, and that, as in all great undertakings, it behooves a man to do his "behoovenest."

But those who have been over the route have declared themselves on occasions, and there is no copyright on what they said. Russell Sage, who has dealt with millions as familiarly as a soda fountain proprietor does with nickels, and who would regard it as a wanton extravagance to pay more than $16 for a business suit, declares: "Be honest, industrious and economical and you'll be sure to succeed." As he started as an errand boy, he is a pretty fair indorsement for his prescription. Hetty Green, with her $60,000,000 and backbone of chilled steel, advised women to go into real estate, buy "snaps," and after improving the property sell at a nice advance. But she also jerked out the opinion that the most important thing of all for a woman to learn is to mind her own business. It is better thus than if some men had said it. Blind Charles Broadway Rouse, who has offered one of his six millions to have his sight restored, says that "industry, integrity, economy and promptness; learning when to buy, where to buy and how to buy; buying and selling for cash, and quick sales and small profit, will do the business."

Collis Huntington, who has had a repeat or two in his race for fortune, making his first start as a country merchant, puts it thus: "The best way to become rich is not to talk too much during business hours." "Don't let your competitors know what your next move is. Eight hours' sleep every day and twelve hours' work, do a little more than you agree, meet bills as they fall due, put by a $1 bill out of every five you earn and invest it in some sound banking, railroad or real estate enterprise," are among the tips dropped by D. O. Mills. Henry Clews' scheme is to buy cheap and sell dear. It sounds easy. And he did it. The former messenger boy is a multi-millionaire.

Andrew Carnegie: "Five things are necessary. They are push, squareness, clear-headedness, economy and rigid adherence to the rule of not overworking. But the final question will be, What has he done for his fellows?" As he comes out of the scrimmage with a surplus of a quarter of a billion, he is now worrying his declining years with the vexed problem of doing for his fellows.

The Consumption of Beer.

It is estimated that the consumption of beer in the entire world amounts to $1,080,000,000 per annum. This seems to be an almost incredible figure, but does not appear so strange when it is considered that the beer which is consumed throughout the world in a single year would make a lake three and three-quarters miles long, a mile wide and six feet deep.

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THE UNITED STATES EXPERIMENTAL MODEL BASIN.

Through the courtesy of Chief Constructor Philip Hichborn we are enabled to present our readers with a full description of the experimental basin recently completed for the navy. It is usual for information concerning an installation of this kind to appear in a paper before a technical society; but in view of the general public interest in the subject, the Bureau of Construction and Repair has decided to depart from its usual practice.

The value of towing experiments upon small scale models of ships for the purpose of deducing the resistance of a full-sized ship from that of the small model was demonstrated by the late Mr. William Froude, who, at his own expense, started a small tank for such experimental work at Torquay, England, about 1870. The English Admiralty subsequently recognized the value of his work and assisted him in it, later building a larger basin at Haslar, near Portsmouth, which is now in charge of Mr. R. E. Froude, son of Mr. William Froude. Other governments, notably Italy and Russia, were induced to establish model basins, which were largely copies of Froude's basin; and one firm of private builders—Denny Brothers, of Glasgow, Scotland—was sufficiently enterprising to build a basin for its own use.

The Construction Bureau of our Navy Department has appreciated for many years the value of an experimental basin, but it was for a long time unable to secure an appropriation for the purpose. Congress finally, about two years ago, granted $100,000 for this work, the grant being largely due to the efforts of the late Congressman Hilborn. The basin proper was completed the latter part of last year, and the special machinery and apparatus have now been completed and installed, after a good deal of delay, due indirectly to the war with Spain.

The basin is located in the southeast corner of the Washington navy yard. The accompanying photographs give a very fair idea of the external and internal appearance, and Fig. 8 shows the construction of the main body of the tank proper. The building is 500 feet long and about 50 feet wide inside. The water surface of the basin is slightly shorter than the building, being about 470 feet long. The deep portion is about 370 feet long, the south end, from which runs begin, being shallow. The water surface is 43 feet wide, and the depth from top of coping to the bottom of the basin is 14 feet 8 inches. The basin is materially larger than any other in existence. The nature of the ground was such as to render the construction of a thoroughly tight and stable basin somewhat difficult; but owing to the small space available at the Washington yard, it was necessary to locate it upon its present site. The bottom of the basin proper is made up of a layer of broken stone upon which is a thin layer of concrete; then a half inch of Neuchatel asphalt; then about 9 inches of concrete in 16-foot lengths, the keys between the various lengths being filled with Bermudez asphalt, and the whole inside surface covered with the asphalt. The heavy side walls are 6 feet thick at the bottom, 6 feet deep and about 4 feet 6 inches thick on the top, not counting the molded stone coping. They are in 40-foot lengths with a square key between adjacent lengths filled with Bermudez asphalt. The side walls rest upon a double row of piles, and in addition there is sheet piling completely around the deep part of the tank. The shallow part of the tank at the southern extension is also carried on piling, as it actually overhangs the water.

The contractors for the building and basin complete were the Penn Bridge Company, of Beaver Falls, Pa., and the sub-contractors for the concrete work and the basin proper the Cranford Paving Company, of Washington, D. C.

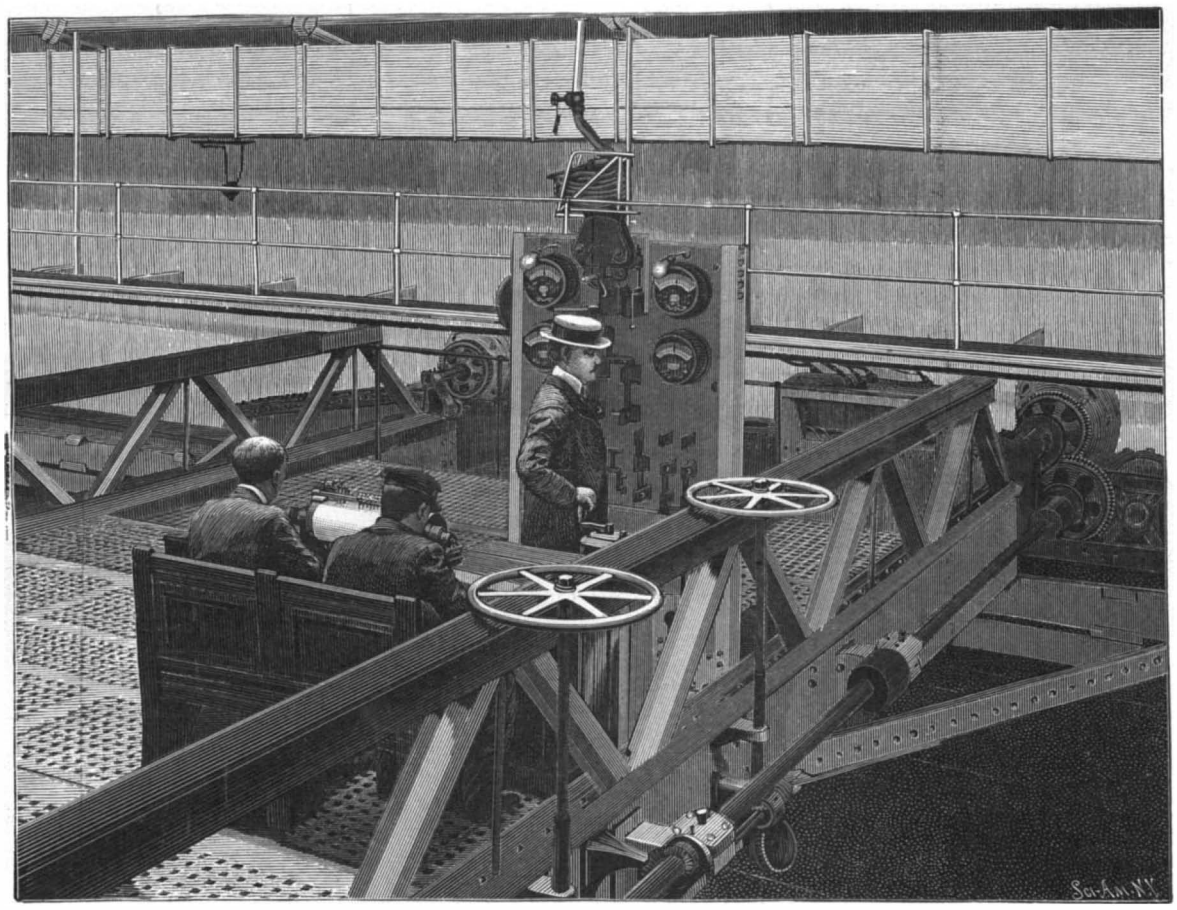

Fig. 6. Towing Carriage with Observers at Work.

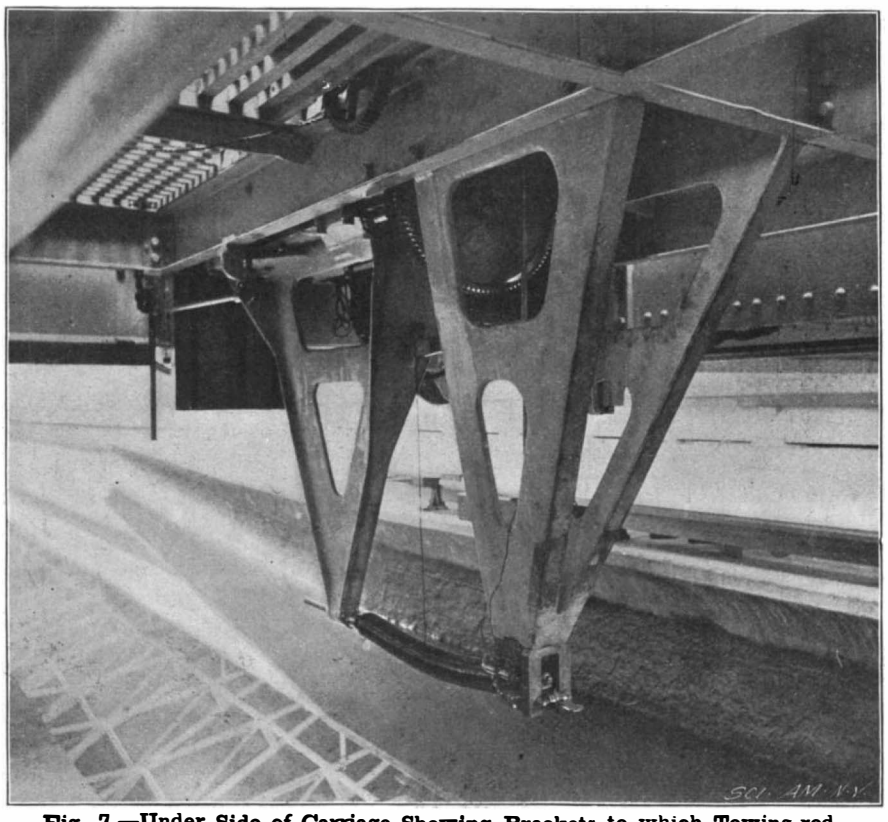

Fig. 7.—Under Side of Carriage Showing Brackets to which Towing-rod is Attached.

THE UNITED STATES EXPERIMENTAL MODEL BASIN.

The law authorizing the construction of the model basin also authorized experiments to be made for private shipbuilders, provided they defrayed the actual cost of the same, it being understood, of course, that such experiments should not interfere with naval work. This being the case, it was necessary to lay out the plant with a view to the rapid and economical turning out of routine experiments, and to this end the endeavor has been throughout to use machinery for as many of the operations as possible. The foreign tanks invariably use paraffine for the construction of models, and generally make them from 10 to 14 feet long. The climate of Washington is so warm in the summer that it was found impossible to obtain paraffine which would retain its rigidity satisfactorily, and, moreover, it was the desire of the Bureau of Construction and Repair to make the models as large as possible, thus eliminating one source of inaccuracy in applying the model experiments to full-sized ships. For these reasons wood was adopted as the material for the models, and after some difficulty a satisfactory varnish was found which rendered the surface of the wood to all intents and purposes absolutely water-tight. The standard length of model used is 20 feet. A model 20 feet long may not seem much larger than one 12 feet long, but when it is remembered that the displacements of these two are respectively as 8,000 and 1,728, it will be seen that the 20-foot model is nearly five times the size of the 12-foot model.

The method of building the model is as follows: The "lines" of the ship invariably include a body plan giving sections at moderately close intervals. From this body plan new sections are drawn to the proper size for a 20-foot model, by means of the eidograph or large pantograph shown in Fig. 2. These sections are cut out of paper, and then transferred to wooden boards which are sawed to shape. These boards are next erected in their proper relative positions upon the erecting table shown in Fig. 3, each board section being clamped in a vertical plane. They are then covered with battens about ⅛ inch thick and tapering from amidships toward the end, making a "former" model, the surface of which is planed smooth. In cutting out the sections allowance is made for the thickness of the battens which have to be nailed upon them. Meanwhile, a rough block of shapes and dimensions to enable the finished model to be cut from it has been prepared and glued together under pressure in a large hydraulic press. This block is placed upon the upper table of the model-cutting machine, illustrated in Fig. 4, the "former" model being placed upon the lower table. The model-cutting machine works upon the principle of the Blanchard lathe, a roller transversing the surface of the "former" model and saws or cutters working upon the surface of the model proper. The bulk of the material is removed from the block by means of the saws, which are shifted along a short distance at a time. Rotary cutters are then applied which finish the surface of the model very close to the desired shape. The model is then removed from the cutting machine and finished by hand; a very small amount of hand work, however, being found necessary. It is now ready for varnishing and the attachment of any appendages, such as bilge keels, struts, etc. It is finally taken to the measuring machine as shown in Fig. 9, and careful measurements made of its exact form and shape, which not only enable the staff to determine whether the model represents the lines desired, but gives an exact record of the actual shape.

The model is now ready for the towing experiments. Figs. 5, 6 and 7 show the carriage used in this work, Fig. 6 showing the observers in position upon the carriage. It runs upon eight wheels and spans the full width of the basin, as shown. The platform in the center, carrying the recording apparatus, can be raised or lowered at will. Electricity is used to drive the carriage, and it may be mentioned incidentally that electricity is used for all mechanical work in connection with the model tank. The speed of the carriage is varied not only by making various combinations of the four motors—one to each pair of driving wheels—but by controlling the output of the generator in the power station, which is, perhaps, 100 yards from the tank. This control is on the Ward-Leonard system, and is very similar to that used to control the motion of heavy turrets on board ship. By means of a resistance box on the carriage the current through the field coil windings of the generator is increased or decreased at will. The revolutions of the generator being kept constant by a delicate governor, the amount of current generated varies with the amount of current through the field coils of the magnet. The whole of the current generated is passed through the motors, and in practice it is found that a very exact regulation of speed is obtained by this combination. The carriage itself, with its fittings, weighs in the neighborhood of 25 tons, so that it alone forms a kind of fly-wheel, and is not subject to sudden variations of speed. The speed of the carriage can be varied from $\frac{1}{10}$ knot an hour, or 10 feet per minute, to 20 knots an hour, or 2,000 feet per minute.

The principal difficulty in connection with the use of high speeds, which, while not necessary for the bulk of the experiments, will be of great value in certain special experiments, is to stop the carriage when it is once under way. The electrical control acts as a brake, be-

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cause when the current is shut off the motors become generators, but this could not be relied upon for high speeds, since the sudden rush of current due to possible unskillful manipulation would throw the circuit breakers, thus opening the circuit and cutting off the current entirely. For these reasons there is at the north or terminal end of the basin a double system of brakes to take hold of the carriage. The first is a friction brake consisting of two strips of iron on either side pressed together by hydraulic cylinders. These are forced apart by a slipper on the carriage about 10 feet long, which, as well as the brake strips, is kept thoroughly oiled, so that the coefficient of friction for stopping, though low, is fairly definite, and sudden jerks are avoided. The pressure in the hydraulic cylinders is controlled by an accumulator and a pump driven by electricity. Great care has been taken in connection with this part of the installation that it may be always in working order, and any trouble or breakdown, except that of the pump itself, which runs all the time, will simply result in setting the pressure at a maximum. This maximum is 600 pounds, but it has been found by actual experiment that with 500 pounds pressure the carriage is brought safely to rest when it enters the brakes at a speed of 20 knots. It is not expected in practice to repeat this often, since even for the high speed runs the electrical brake will be used to reduce the speed of the carriage before the friction brake is used. In addition to the friction brake there is what is called the emergency brake, so that in case the friction brake fails for any reason, the carriage would still be caught. This brake consists simply of a piston about 16 inches in diameter working in a cylinder which is submerged in the water of the tank and connected by wire cables to a hook which takes hold of the carriage. The head of the cylinder has a round hole and the piston rod is tapered so that as the rod is drawn out by the motion of the carriage the hole is gradually closed, the whole being almost exactly upon the principle of the hydraulic gun recoil brake. An escape is provided for the water around the piston when it starts from rest to avoid sudden accelerations from the whole mass of water in the cylinder.

The dynamometric apparatus is designed to avoid entirely the use of multiplying levers or other devices involving the possibility of friction, and here again electricity is enlisted. The recording drum is fitted with apparatus for recording the time and distance, as usual. The resistance is measured directly by a spring, the arrangement being as indicated in Fig. 7, which is a view underneath the carriage. The forward end of the spring is attached to a bracket, which is screwed forward or back by an electric motor, and a rigid arm runs up from the bracket, with a pencil recording its position on the drum. The record then is of the position of the forward bracket. The after end of the spring takes hold of a small cross-head to the other end of which again is attached a towing rod which takes hold of the model. This cross-head has a very slight play between stops in the after fixed bracket, and when it touches either stop closes an electrical contact which again throws an electric clutch by means of which the motor, running all the time, screws forward or back the forward bracket, thus increasing or decreasing the tension of the spring until the contact is opened again.

There are many refinements which cannot be indicated in this brief description; for instance, the operator can throw either clutch at will or set them to work automatically. In practice, when about to make a run, the operator works the bracket forward to the immediate vicinity of the position which he knows it will assume during the run, the approximate speed of which he knows. The carriage is then started and after a uniform speed has been obtained, which, for speeds up to 12 knots, is done within 50 feet, he throws in by a single motion of one handle the automatic appliances which start the drum and record time, distance and resistance. In this way the resistance pen has to move but a small distance to reach the position of equilibrium and almost immediately becomes steady. It will be seen that with this device friction is eliminated. The accuracy obtainable depends upon the closeness with which the automatic stops at the after end of the spring can be set. In practice it is found that these can be set to give a play of about the fiftieth of an inch, and as the springs will extend 10 inches, the results obtained are practically exact as indicating the pull of the spring.

It now remains to describe the method by which the amount of this pull can be determined in any instance. There is fitted at the starting end of the basin a kind of weighing machine with one vertical and one horizontal arm. This is delicately balanced, and when the model has been connected up and is ready for towing, a certain spring being in use, the vertical arm, or rather a knife edge which bears upon the vertical arm, is connected to the model. A known weight is then put into the scale pan attached to the horizontal arm. The automatic attachment in connection with the dynamometer spring is thrown into gear, and the weighing machine is screwed forward or backward until it is in perfect balance and the record pen recording the position of the spring is at rest. It is evident then that the pull of the spring is exactly equal to the weight in the scale pan. There are a number of pens which can be shifted parallel to the recording pen and set in a definite position to record upon the drum. One of these pens is set to correspond to the position of the resistance pen, then another weight is put into the scale pan, a second pen set to record the resistance, and so on. It is evident then that when the run is made these fixed pens mark off upon the paper a scale for resistance, avoiding all complications of corrections for temperature of spring or anything else. A complete double outfit of springs is already provided for measuring resistance from 1 pound up to 500 pounds, and for special work additional special springs will be obtained.

In connection with the question of temperature, it is impossible to avoid a certain variation of the temperature of the water, but as ample heating facilities are provided, as indicated in the pictures of the building, where the heater pipes are shown, it is not expected that the variation of temperature during the year will be sufficient to necessitate correction in the results of experiments on this account. The basin is filled from the water system of Washington, and will hold 1,000,000 gallons. Two electrical centrifugal pumps are provided, the larger of which will empty the tank in about four hours. The smaller pump is a 4-inch pump, used for draining the last water from the basin and also for pumping the water from outside the basin, to avoid the possibility of undue pressure upon it in case it is left empty for some time. This is necessary, since the basin is but a short distance from the Potomac River, and extends 8 or 9 feet below mean tide level. A gage indicates the level of the outside water, which is found to be, as a rule, about 6 feet below the water in the basin.

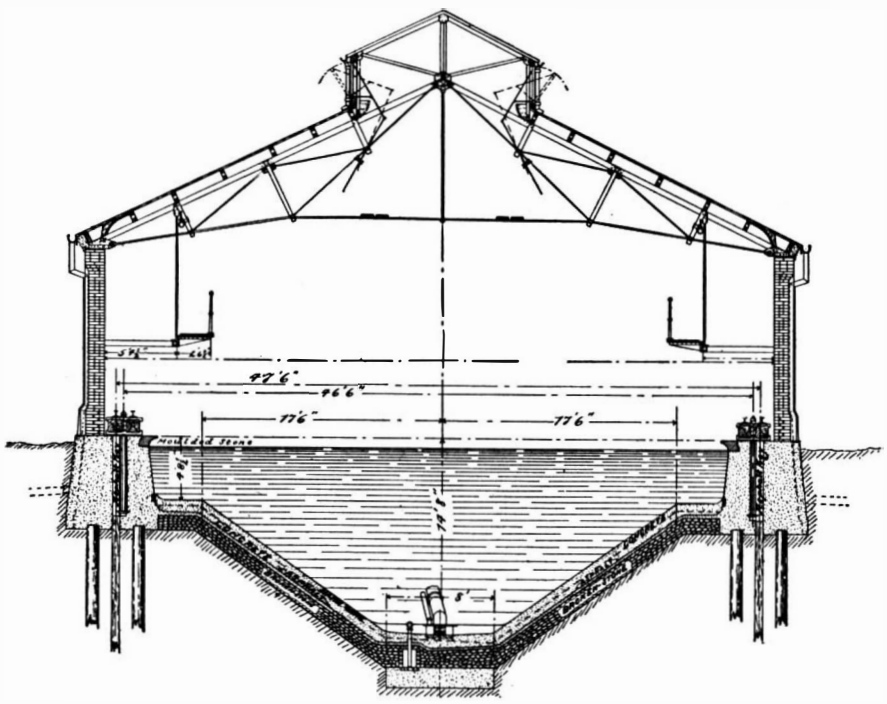

Fig. 8.—Cross-section Showing Construction of Model Basin.

The leakage from the basin, which is very slight, and the evaporation, are made up with filtered water, an animal bone filter being installed with a capacity of from 50 to 100 gallons per minute, depending upon the turbidity of the water. In practice a small stream of fresh filtered water is kept running into the basin all the time, and the level maintained wherever desired by an adjustable overflow.

The building and tank or basin proper were designed by the Bureau of Construction and Repair, as well as the machinery for making models. The electrical installation was fitted by the General Electric Company, many of the electrical details of design being also due to them. The carriage proper was built by the William Sellers Company, the dynamometer apparatus partly by the Sellers Company and partly by Saegmuller, of Washington, who also built the large eidograph. All of these are upon the designs of the Bureau of Construction and Repair. The model-cutting machinery was built by Detrick & Harvery, of Baltimore, Md., to the designs of the Bureau of Construction and Repair.

The model basin staff is now at work upon experiments to determine frictional coefficients of varnished surfaces and other constants needed in its use. Experiments are being made as opportunity serves upon models of the naval vessels already built and tried for the purpose of accumulating data which will be constantly needed during the life of the tank. As soon as preliminary lines of the new third-class cruisers authorized at the last session of Congress are completed, experiments will be made with them in the tank with a view to introducing any refinements or improvements found desirable.

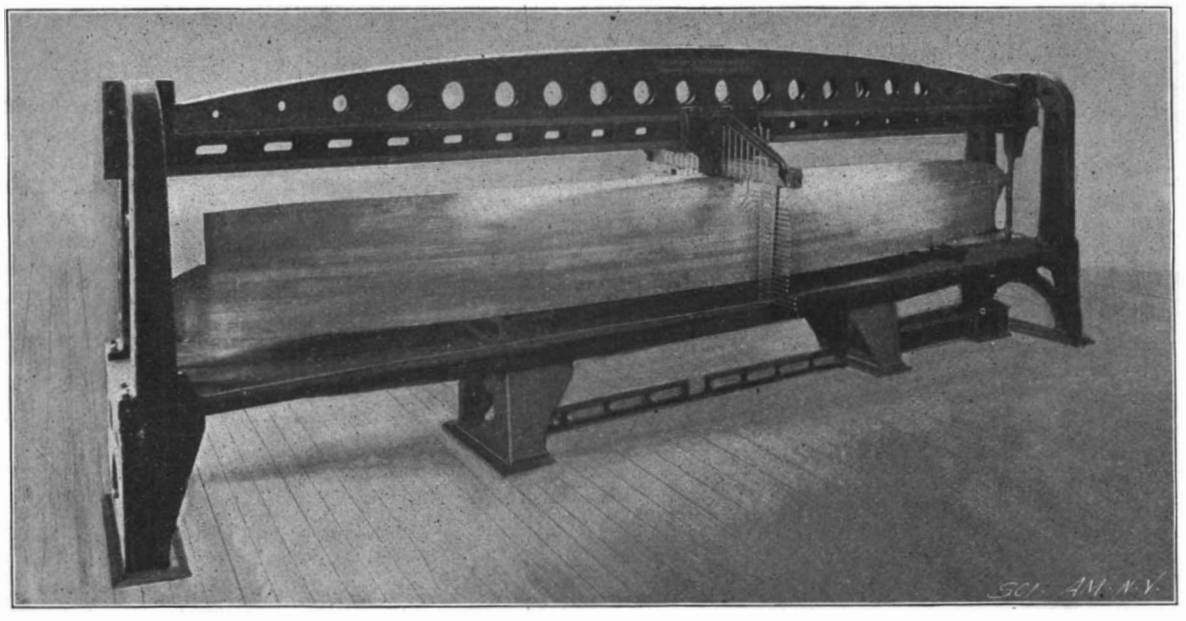

Fig. 9.—Model Measuring Machine.

THE UNITED STATES EXPERIMENTAL MODEL BASIN.

A Trans-Continental Automobile Trip.

The first trans-continental automobile trip will be begun on July 1. Mr. and Mrs. John D. Davis will start from The New York Herald building for the longest automobile run on record. Besides the length of the trip, it will be a remarkable test of American self-propelled vehicles over the worst of American roads. In Europe the longest run that has been made was 621 miles over the most perfect of roads. The trip from the Atlantic to the Pacific will cover about 3,700 miles. There are some good stretches of road in the East and some fair roads in the middle West, but in the Rocky Mountains the coach routes will be most trying. The vehicle is what is known as a "continental touring car." It was built in Stamford, Conn., by the National Motor Company specially for the trip, the parts being made stronger than the same type of vehicle used for good roads. The motor is a gasoline one. The carriage has special gears which will enable it to climb mountains of quite a steep grade.

The route will be up the Hudson Valley to Albany, then by way of Syracuse, Rochester, Buffalo, Erie, Cleveland, Toledo, South Bend, Chicago, Davenport, Des Moines, Omaha, Denver, Ogden, Sacramento, and San Francisco. If the vehicle reaches the latter city, the stop will be made at The San Francisco Call building. Mr. Davis expects to reach San Francisco early in August.

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NAVAHO INDIAN GAMBLERS.

BY COSMOS MINDELEFF.

Gambling games of one kind or another form a not inconsiderable part of the mental life of all savage peoples, who find in the vagaries of chance, aided more or less by skill, the occasional exaltation of mind which all men demand in one form or another.

Much has been written about games of chance, with especial reference to their origin, but this aspect of the case—the part which they play in the life of to-day—has been generally overlooked. Indians, negroes, Chinamen, have been hastily classed as inveterate gamblers, and such indeed from one point of view they are. But there is something more than this in the universal passion for play which characterizes all the lower races, without being by any means confined to them.

The negro, whose whole soul seems absorbed in the formula "Come seben" or "Come eleben," in his favorite game of craps, is yielding to the same impulse which causes the Chinaman to expend all his earnings in the never-ending but to him always fascinating mysteries of "fan-tan," and which justifies the Mexican, in his own mind, for the loss of many hours and a few, if not many, dollars in the allurements of monte on the sunny side of his adobe shack. The fondness of many business men for a "quiet little game" is an exhibition of the same desire for mental excitement and change, different, perhaps, in amount, but not in kind, from that which holds a little band of Indians around a blanket spread upon the ground for days at a time while the chances of the game are making one man rich and the others poor.

From this point of view the gambling games of the Indians have a certain value aside from the picturesqueness which is nearly always an accompaniment. All kinds of games are to be found among them, native as well as imported, and while the latter are gradually supplanting the former on account of greater convenience, and perhaps because of quicker action, the strictly aboriginal games are by no means extinct. They can still be found in full swing in many parts of the United States which are a little remote from the usually traveled lines and but little changed by contact with our own civilization.

There is little doubt that in their origin many if not all of these games were real religious ceremonies, designed to foretell the future, but they also played the same part in ancient times that they do to-day in supplying a mental stimulus. Some of the games have come down practically unchanged in form, although now played under entirely different conditions from what they were originally. Among them perhaps the most striking is the game of moccasin, which seems to be unquestionably the forerunner of the "little joker," which every year proves so effective at country fairs in luring dollars from the pockets of the unwary. This game was once widely distributed among the Indian tribes, and it has been said that it is now extinct; but it can be seen to-day in its aboriginal form in any of the outlying parts of the Navaho reservation in Arizona.

The paraphernalia of the game are very simple and always at hand, consisting merely of a knife or other hard substance—a pebble will do—and the moccasins of the players. The game is usually played at night, although sometimes it extends over several days, and in its native setting has a weirdness and fascination which the modern fakir cannot claim. Five persons usually participate, four of them actively, while the fifth acts as musician, but usually a much larger number watch the progress of the game and perhaps place a bet occasionally.

Picture a rude shelter of green boughs, roughly circular in form, placed in some thicket, or under the overhanging branches of a large tree. In the center a blanket is spread upon the ground, surrounded by fifteen or twenty Indians squatting about it, or leaning over, intently watching the play. Over all the fitful glow and play of light from a huge fire on one side. The effect is heightened by a weird song, which is a constant accompaniment of the game, and which rises and falls as the excitement grows and wanes, reaching, sometimes, such frenzied accents that the casual passer-by might easily mistake it for a war song.

The players take their places at the four corners of the blanket, and are paired off by couples. Each player contributes one of his moccasins, and the winner of the toss lays them on a blanket upside down, and about six inches apart, with the toes pointing forward. Then with his left hand he lifts each moccasin in turn, and makes a pretense of putting the knife under it, making many passes and using every precaution to deceive his opponents and the spectators. During all this time the musician keeps up a continuous drumming, which he accompanies with a song. In the song the others all join, but the opponents of the players eagerly watch for some slip, which will give them a clew as to which moccasin the knife or "little joker" is concealed under.

When the knife is hidden to the satisfaction of the player, he suddenly calls out "Ho" in a loud voice, and the singing drops to a low murmur. One of his opponents is provided with a short stick and he raises it threateningly over the moccasins, first over one, then over another, while all conversation ceases and every eye is fixed intently upon him. The interest becomes more and more intense as this by-play proceeds until finally the man with the stick places one end of it under the moccasin he selects and turns it over. Should the knife be found under it he wins, and the former player relinquishes to him the moccasins and knife, together with the stakes. It is thereupon his privilege to hide the knife while his opponent must guess at its

TYPE OF NAVAHO INDIAN.

location. This reversal in position gives the native player a much better chance to come out even on the play than the average fakir who works the game at country fairs is disposed to allow his victim.

The peculiar traits of the Indian character, especially his pronounced improvidence, is much in evidence in his gambling, and it is not unusual for a man to ride up with an elaborate outfit, horse, saddle and silver bridle, a silver belt worth $40 or more, strings of silver beads and coral necklaces, silver buttons on his moccasins and leggings, etc., the whole rig worth perhaps $200, and to leave a few hours later, bare-footed and carrying his saddle on his back, bereft of buttons, bracelets, and everything except his clothing. Through the operations of the savage law of hospitality, whereby no man can want for food if his neighbor has any, the evil effects of high play are so much diminished that no man hesitates to indulge to any extent he may wish, and the same man may be cleaned out a dozen times in as many months without apparently learning wisdom from experience.

A REMARKABLE GEYSER IN SOUTHERN CALIFORNIA.

The introduction of American and Spanish or monte cards has given greater opportunities for play and has done much to develop it. The most persistent efforts by many different agents to break up the practice have been entirely without effect, and the average Indian agent now simply ignores what he cannot control. It is not unusual to see small gambling parties in sheltered nooks and corners of the agency buildings, playing for the goods and rations which have just been issued. The idea of obtaining something for nothing is quite as fascinating to the Indian as it is to some white men, but among the former no odium attaches to the gambler, for all are gamblers. It is only on the hypothesis that play fills some pronounced want, some great mental need, that its universal distribution among the Indians can be explained.

A REMARKABLE GEYSER IN SOUTHERN CALIFORNIA.

The people of Southern California have recently been favored with one of the most extraordinary exhibitions of natural phenomenon on record, one which has even astonished beyond measurement all classes of a community familiar already with instances of what nature can accomplish when it sets out to do something out of the common.

Southern Californians are so used to shocks of earthquakes, incipient volcanoes, or threatening tidal waves, that it takes something extremely eruptive to disturb their ordinary composure, but the successful effort of a rural rancher in his search for water with which to irrigate his fields, parched with a long drought, has turned the gaze of the whole State toward the little town of Whittier, a hamlet located in the neighborhood of Los Angeles.

Some weeks ago a farmer named Myers, living at Santa Fe Springs, began sinking an artesian well. Others in the neighborhood had successfully tapped a subterranean flow at depths of from 300 to 400 feet and Mr. Myers hoped for a successful issue to his enterprise. By slow stages the drills descended until a depth of 500 feet was attained. This was on Sunday, May 14. A drill 200 pounds in weight was employed, and the prospect of tapping a good flow of water was becoming more and more encouraging. A 10-inch pipe had been sunk some distance and the usual preparations made for controlling the flow when it did make its expected appearance.

The heavy drill was working with its usual monotonous regularity when, after one deep plunge, a loud roaring sound was heard coming from the well, accompanied by jets of muddy water and the outburst of heavy stones. Soon after, the drill itself made its appearance, followed by a grand column of water which forced itself higher and higher until the top reached an elevation of 500 feet. The flow was accompanied by vast quantities of gas smelling of sulphur strongly and igniting when fire was applied, burning with a strong blue flame. Oil in considerable quantities was mixed with the flow. The stones were thrown to an equal height with the water, and the exhibition of tremendous force was appalling to the last degree. No geyser of the Yellowstone ever displayed such activity. The column of muddy water was like a great pillar extending almost to the clouds, and falling back to earth again in graceful festoons. The force exerted was equal to a thousand powerful engines. For two weeks this phenomenon has been active, though some diminution of the force exerted is beginning to be apparent. The flow of water is enormous, and the country being flat some difficulty is apprehended in its control. The photograph was taken at the time when the column of water was fully 500 feet high.

The Current Supplement.

The current SUPPLEMENT, No. 1227, has a large number of papers of unusual interest. "A Few Spiders and Their Spinning Work," by Miss Mary I. Cunningham, is concluded. This is one of the most remarkable natural history papers that it has been our good fortune to publish, and is profusely illustrated. "Gems of Maine" is a paper by E. R. Chadbourn. "Sanitary Lessons of the War" is an abstract of a paper by Surgeon-General G. M. Sternberg. "Why Do the Dials of Our Timepieces have Twelve Divisions?" is an interesting article. "Color Photography," by R. W. Wood, is a valuable paper on the subject by a specialist. "Perfume Plants" is a paper by Dr. A. W. Miller.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

SEED-PLANTER.—Samuel M. Littel, Pleasanton, Kans. The planter comprises a seed-plate having a number of rows of seed-containing holes and a slide having a single hole therein. The slide is adjustable beneath the seed-plate so as to bring its hole in register with holes in any one of the rows in the seed-plate, whereby the number of seed dropped may be varied while the planter is in use. The machine is of special service in fields having ground of varying richness, the more fertile portions being able to support a larger number of plants.

HARROW-FRAME.—Louis G. Helmbold, Bucyrus, Ohio. The harrow-frame is rigidly constructed and is provided with a means whereby its supporting-wheels may be quickly raised or lowered by the driver. The levers adapted to raise and lower the wheels are so located that they may be conveniently manipulated, and that one wheel may be raised and the other wheel left in its traveling position when necessary. The machine, it is claimed is not only simple and durable, but will effectually pulverize the earth over which it is passed.

POTATO-DIGGING ATTACHMENT FOR PLOWS.—Oliver C. Campbell, Coldwater, Mich. This device is designed to be attached in place of the point to the moldboard of any plow. The attachment is so constructed that a series of spring tines or fingers, forming a portion of the detachable share or point, will receive the earth, potatoes and plants thrown up by the plow, sift the dirt from the potatoes, and distribute the potatoes and plants in separate rows upon the ground.

Bicycle-Appliances.

BICYCLE.—J. Carlyle Raymond, Old Bridge, N. J. This improved bicycle is arranged to permit a rider to change the gearing from a high speed to a low speed, or vice-versa, by means of a novel arrangement of gear-wheels and pinions in combination with the drive-wheel. The inventor has also devised an ingenious electrical attachment by means of which it is possible for the rider to operate the bell and brake, and by means of which danger signals can be displayed in the rear to prevent collisions at night.

Engineering-Improvements.

COMPOUND ENGINE.—Willie H. Johnson, Navasota, Tex. In the use of compound expansion-engines a difficulty is experienced by reason of the back pressure of the exhaust from the action of the primary cylinder on its piston. The present invention seeks to avoid this difficulty, by cutting off the exhaust after it has passed into the secondary cylinder, and retaining it in that cylinder. Simultaneously with this cutting off, an exhaust-port is opened to release the exhaust from the piston of the primary cylinder, so that the exhaust will act expansively in the secondary cylinder and will be freed from the back of the piston in the primary cylinder.

Electrical Apparatus.

ELECTRIC MOTOR.—Alfred Hinman, Forest City, Mo. The object of the inventor has been to arrange the armature with relation to the field so that the tendency to draw the armature transversely to the armature-shaft will be reduced to a minimum, thus preventing binding or wearing between the shaft and its bearing-boxes. The armature comprises a frame consisting of two end sections attached to the armature shaft. These end sections are of non-magnetic metal and have outwardly-extending flanges to which the armature-magnets are attached. Each core of an armature-magnet consists of a number of iron plates arranged closely together and parallel, the middle ones being of the same width, the outer, however, being made progressively narrower from the inner to the outer edge of the core. An improved construction of gear for the armature-magnets is provided and also an improved construction of field-pole pieces.

Mechanical Devices.

HAND PRINTING-PRESS.—Walter E. Van Valkenburgh, Manhattan, New York city. The press has a carriage having sliding movement. Arranged for locking engagement with the carriage is a form which receives the type. A platen located above the carriage moves to and from the form, and is tension-controlled in an upward direction. A hand-operated gear has rack-and-pinion connection with the carriage and is connected with a cam which operates a compressing device for the platen. The simplicity of making desired changes in bills of fare and the like, without a knowledge of type-setting, and the accuracy and rapidity of operation should recommend this machine to hotel-proprietors.

CASH-REGISTER.—Charles J. Fauvel and Norman Collins, London, England. The improvements in this device relate first to key-operated mechanisms, wherein the mechanism for recording sums of one denomination of coin is actuated through the medium of a set of keys and of a barrel which always makes a complete revolution for each sum of money registered, there being as many drums and sets of keys as there are denominations of coins. The keys are so coupled that the simultaneous partial depression of two or more keys belonging to different sets will be completed for all those keys by the continued pressure of the finger on only one key, and the whole sum will be recorded, notwithstanding that the pressure on one or more keys is relaxed before complete depression.

DOUBLE MACHINE-TOOL.—Ignaz Roederer, Prague, Austria-Hungary. This inventor has produced a double machine-tool arranged so that from a main driving-shaft the two tools are moved independently of each other and so that the tool on one side of the machine is given a rotative movement while the tool on the other side is given a reciprocating motion. The tool-frames may be brought into a vertical, horizontal or slanting position, and are so arranged that different tools may be affixed to them. The machine so constructed is capable of performing all operations such as boring, turning, cutting, planing, shaping, key-grooving, and the like. The same blank, when once secured, may be variously treated.

CARPET STRETCHER AND TACKER.—Charles P. Knapp, Deposit, N. Y. This invention provides a device on which a hammer is mounted whereby to drive a tack fed from a magazine or belt to a point just behind the head of the stretcher, and in a position to be engaged by the driving devices. The action of the stretching-head is especially effective, and the tacks are so fed when the desired point is reached, that they will be in a direct line with a plunger adapted to be impelled against the tack by the hammer. The blows of the hammer may be repeated as often as necessary, without moving the device or allowing more than one tack to come in line with the driving-plunger.

Railway-Contrivances.

SWITCH.—Paul O. E. Boudreaux, Theriot, La. This switch is so constructed that the locomotive or car of a train engages and operates the switch-throwing mechanism to switch the train automatically from the main track to a siding, and vice-versa. It has been the purpose of the inventor to construct the switch-throwing mechanism so that it may be effectually operated by the train under all circumstances, and that the possibility of accidentally derailing the train by running on or off an open switch may be avoided.

RAIL.—Daniel Minthorn, Watertown, N. Y. The rail comprises a triangular casing having the upper end of its inclined sides bent outwardly to form flanges, and a head formed at its under side with longitudinal grooves for engagement by the flanges. No fish-plates or like devices are necessary; the several parts can be readily assembled without any special fastening devices; and the casing securely fastened in position on the ties by means of a spike.

Miscellaneous Inventions.

WIRE-TIGHTENER.—Niels J. Rasmussen, Neola, Kans. The wire-tightener consists of a body comprising a handle and a loop-head. A lever is pivoted in the body and is adapted to extend within the loop-head. A plunger is pivoted to the lever. The wire to be tightened is secured to the loop-head, and the lever operated to take up the slack in the wire.

BEER-COOLER.—Henry Reininger, New Orleans, La. The cooling liquid is received by inner pipes which are surrounded by outer pipes adapted to conduct the beer to be cooled. Spaced heads located at the ends of the outer pipes form closed chambers communicating with the outer pipes. Bends or elbows within the chambers connect the ends of adjacent inner pipes. It is claimed for this device that it is simple in construction, effective in operation, is economical in the use of cooling liquids, is arranged to permit cleaning, and reduces the loss of the liquid under treatment to a minimum.

DETACHABLE TIE-FRAME.—William J. Smith, Brooklyn, New York city. This tie-frame, designed to facilitate the forming of the bow of a tie, consists of a plate having a large opening in its middle for the reception of a portion of the tie and the collar-button. The plate has prongs projecting upwardly, which prevent the movement of the frame. The device is simple and can be very cheaply manufactured and readily arranged in place while applying the necktie on the collar to prevent the shifting and disarrangement of the bow.

APPARATUS FOR MOLDING OR PRESSING BUNCHES OF CIGARS.—Asher Woolf, 21 Victoria Park Road, London, E. England. The apparatus consists of a two-part mold having a swinging spring-bar centrally pivoted to one part of the mold and having its ends projected beyond the mold. Presser-slides are mounted at the ends of the other part of the mold and have end portions capable of engaging respectively with the ends of the swinging bar. Each presser-slide has a portion projected outwardly from the mold. In the mold-section a rock-shaft is mounted carrying the presser-slides. Cams on the rock-shaft coact with the outwardly-projecting portions of the presser-slides.

TYPE-WRITER.—Robert C. Little, Pittsburg, Pa. The present invention provides an improvement in type-writers having the type-levers disposed in the arc or segment of a cylinder, the impression-point being at the axis of the cylinder. With this construction as it now exists, the type-keys are spread over a large surface, radiating as they do from the axis of the cylinder. The present invention provides an arrangement for such machines by which the keys may be located close together, occupying the same relative positions as in the Remington machine.

GRATE.—Wilbert Black, New Orleans, La. The purpose of this invention is to provide a fireplace grate in which the draft may be more effectually controlled than in grates as hitherto constructed, which purpose the inventor accomplishes by arranging above the grate a peculiarly-constructed damper acting with the blower-shield to regulate effectually the draft in the flue and thus control the combustion of the coal in the grate.

WHEEL-RIM.—Edgar M. Birdsall, Buffalo, N. Y. The wheel-rim is formed of two strips, one of which has two longitudinally-extending undercut grooves between which is a longitudinal tongue, the other strip being provided with two longitudinal tongues located one on each side of a longitudinal groove, the tongues and grooves of the second strip being respectively adapted to engage with the grooves and tongues of the first strip in such a manner as to form a dovetail connection.

ACETYLENE-LAMP.—Marius Dreyfus, 109 East 75th Street, New York city. The carbid is contained in a cylindrical holder surrounded by a jacket. Within the holder projects a perforated tube containing a wick, the entrance of the water to the bottom of the tube being controlled by a plug valve. The water is absorbed by the wick by capillary attraction and gradually distributed to the carbid. Devices are provided to stop the generation of gas when it is so desired. The lamp possesses the merit of having no small tubes or valves to become obstructed or clogged.

GATE FOR DRAWBRIDGES.—John P. Cowing, Cleveland, Ohio. The gate is carried by a shaft mounted to slide and to turn. Mechanism operates in conjunction with the opening and closing of the bridge to impart an upward sliding motion to the shaft after the closing movement of the bridge is completed, to cause the shaft to turn in its bearing and move the gate into an open position. The shaft, when released by the mechanism slides and turns back to its former position by its own gravity, to move the gate across the roadway and close it before the opening movement of the bridge.

CIGAR-HOLDER.—Hugh H. Coote, Bisbee, Arizona Territory. This holder is so constructed that the cigar need not have its tip removed, the cigar being held in connection with the holder through the medium of a needle-point and clamping-arms projecting on opposite sides of the needle-point. It is claimed that this is the only holder through which a cigar can be smoked without cutting off the tip. The holder has a strainer for filtering the smoke, and a cell for receiving the nicotine.

PAPER-HOLDER.—Thomas J. Paton, Limestone, N. Y. To provide a paper-holder especially designed for securing a train-order back upon a support, or for fastening sheets of paper to any desired object, is the purpose of this invention. The device consists of a clamp adapted to be attached to a suitable support. The clamp comprises a body-bar terminating in arms and provided with an arch between its ends. Connected with a locking-bail pivoted in a bearing and with the arch of the clamp is a spring-yoke. The clamp is firmly held in locking position by the bail and the spring-yoke.

TALLYING APPARATUS.—Charles L. Sturges, Escondido, Cal. The present invention provides a device in which the voter himself sees his votes counted, without, however, knowing the count of votes that others have effected. The apparatus used consists of a box carrying 288 tallying sections; the voter's ballot, not his hands, is the means of operating the mechanism. The duplicate sections are arranged so that a ballot stretched from end to end of the box, will bring the name of a candidate in juxtaposition with a pin adjusted in the turret. If the ballot be perforated above the pin, the pin passes up through the ballot and permits the tally of a vote, as the box with its 288 sections rotates on its axle; but all the pins over which the ballot stretches will be held down to suppress a tally in instances where there is no perforation.

CUPBOARD-CATCH.—Frank B. Mallory, Flemington, N. J. The catch comprises two parts, a bolt and a strike-plate, including a keeper, each of which parts consists of a single piece. Both parts of the catch are so constructed that while they may be brought together into firm and comparatively noiseless engagement, the wear upon the plate and keeper will be comparatively slight.

ASTRONOMICAL SCALE.—Stephen R. Kirby, Manhattan, New York city. In transforming units of time into units of longitude, it is necessary ordinarily to perform much figuring, which with this device is rendered unnecessary. Moreover, in transforming astronomical time into civil time, it is often confusing to determine exactly the hour and day. The device used to obviate these difficulties comprises two opposing scales indicating respectively the two units in proper proportion, a vernier-slide having a vernier for each scale, a scale having oppositely marked thereon the corresponding hours of the astronomical and the civil day, and a scale graphically representing the yearly equation of time.

BLACKING-BRUSH.—John J. Howe, Wilmington, Del. The blacking-brush comprises a dauber superposed upon a polishing-brush. The handle of the dauber is made hollow to form a receptacle for storing liquid blacking. By opening a valve the blacking is allowed to flow over the boot; by closing the valve the blacking is cut off. It is evident that the blacking, by means of this brush, can be conveniently applied without danger of soiling the hands.

TIMBER-FASTENING.—John C. Homan, Cincinnati, Ohio. The object of this invention is to provide a fastening especially adapted to join sections of timber and to permit their disconnection without tearing out or fracturing any of the parts. The fastening has a plug adapted to be secured to one section of the timber and formed with a transverse passage and with a longitudinal passage in its outer end leading to the transverse passage. A wedge can be passed through the transverse passage to engage the other section of the timber.

VEHICLE-FRAME.—Thomas Hill, Jersey City, N. J. This frame for dumping wagons has continuous hollow side-bars provided at their inner sides with openings for the reception of the ends of the cross-bars. To the side-bars, draw-bars are pivoted at their forward ends, the rear ends being connected with the rear axle. The draw-bars are arranged so as to make them adaptable to the carrying of leaf springs midway of their ends. The springs may be engaged at their arch portion with the draw-bars and secured by means of clips, while their upper ends are in contact with the side-bars, so as to yield readily to the pressure of the load.

ATTACHMENT FOR STRINGED INSTRUMENTS.—Frank Graus, Jersey City, N. J. This invention provides an attachment for stringed musical instruments, such as guitars, banjos, and mandolins, which attachment permits the performer, by pressing a single key, to hold a number of strings to the proper frets on the finger-board and to pick the strings in order to sound a chord. The range of the attachment comprises fifteen different chords, and therefore nearly all the chords used in the performance of ordinary music. Some of the chords, owing to the complicated fingering of the finger-board, would be difficult to play if the attachment were not used.

DEVICE FOR ATTACHING METAL SEALS TO WOOD, ETC.—Albert H. Frankel, Manhattan, New York city. It is customary to secure a metal seal containing a trade-mark over the bung of a barrel. The present invention provides a simple and comparatively inexpensive device by means of which sharp teeth or prongs formed on a seal may be driven into the wood of a barrel without bending. The device consists of a driving portion carrying at its lower end a metal ring having an extension and flange, which ring strongly reinforces the lower end of the driving portion; to prevent the splitting of the end a metal collar is used, held in place by coil springs and guide pins.

STOCK-QUOTATION INDICATOR.—Rudolf Einbigler, Manhattan, New York city. In offices where stock is sold, the quotations are usually written with chalk upon a blackboard. The inventor of this device dispenses with the use of chalk by employing a plate having an opening to expose numerals on a series of drums loosely mounted on a shaft on the back of the plate. Any of the drums may be rotated to disclose a new numeral or fraction; and since each drum is independent of the others, any one of the figures may be changed without changing the others.

POCKET.—Charles Douglis, Manhattan, New York city. This invention provides a made-up or complete garment-pocket so constructed that it may be introduced into a garment through a single slit made in the outside fabric and that the fabric may be completely concealed and protected by a combined shield and flap. A binding for the edges of the pocket is provided, and also a bellows construction which permits the side walls of the pocket to lie closely together when empty.

TILE.—Charles C. Alexander, Bayonne, N. J. Glazed tiles are liable to craze either before or after they are set in the embedding material. To overcome this defect the inventor has glazed or enameled the entire surface of the tile to render the body portion impervious to water and has embedded in the back of the tile broken unglazed pieces. Tiles thus made, not being porous, require no soaking in water, and the cement bedding will set naturally against the back without having its strength impaired.

HEATER.—Charles T. Wise, Sr., New Bridge, Ore. The heater devised by this inventor is designed to be used as a hot air or water heater. The heater has a casing in which a jacket is located separated from the walls of the casing. A water-circulating tube is extended into the casing through the jacket and is formed into a vertical coil within the jacket. The tube is extended from the vertical coil to the front portion of the casing and is there formed into a horizontal coil. From this horizontal coil the tube passes without the casing and is bent into vertically-disposed loops extending around the casing to form connected radiators.

PIPE-WRENCH.—Robert Willis, Manhattan, New York city. To provide a wrench designed for turning plated or highly-polished pipes without marring the finish is the purpose of this invention. The wrench consists of a head having side-bars, the front ends of which are connected by a grip-bar. A strip of yielding material is provided to engage around the pipe and around the grip-bar. A wedge secures the yielding material to the rear portion of the head.

SUSPENDER-BUCKLE LOOP.—Herman Weiss, Manhattan, New York city. The suspender-buckle loop comprises a loop adapted to be engaged by the suspender-web, and a double U-shaped strap-holding loop formed of a single bent wire and with arms of different lengths connected at their upper ends by bends which embrace and pivot upon one portion of the first-named loop. Rollers are carried by the arms which support the straps.

AWNING-FRAME.—Robert H. Weaver, Jersey City, N. J. In this awning-frame the guide-rods usually attached permanently to the window casing are dispensed with, and by means of a peculiar construction the frame is attached directly to the window-casing, enabling one to distend or fold the awning at will. The construction comprises a fixture having a horizontal lug with a laterally-extended portion, a rod mounted to swing on the fixture at a point inward from the laterally-extended portion, a tubular awning-bar mounted to slide on the rod, and a member carried on the bow and adapted to engage with the laterally-extended portion of the lug of the fixture when the bow is in horizontal position.

HARNESS.—J. Carlyle Raymond, Old Bridge, N. J. This improved harness is designed to be used on farm-teams and is arranged to obviate all chafing and rubbing and to prevent the flexible pole or drag-chain from striking and injuring the horses. The harness includes a hame, comprising top and bottom cross-bars arranged for pivotal connection at their middle portions with a supporting frame. Each cross-bar is formed at its ends with eyes in which hame-rods are adjustably secured. A strap-rod on each of the hame-rods extends transversely beyond both sides of the hame-rods.

MEANS FOR CHECKING AND REGISTERING ACCOUNTS.—Walter N. Simpson, Chicago, Ill. This invention provides a checking system for hotels and restaurants whereby the separate and collective accounts of employés may be readily determined and any dishonesty detected. The system comprises a cashier's sheet, an improved and distinctive checker's sheet, and waiters' slip, all numbered consecutively with corresponding numbers, the bar and cigar department requisition slips being used in conjunction with the waiters' slips and as an adjunct thereto. The result is a complete combination whereby registering, checking, and auditing accounts is considerably simplified.

Designs.

SKATE.—Anton Follstad, Elcho, Wis. The especial purpose of the invention is to furnish a snow-skate or street and coasting-skate. The skate-body is inwardly curved at its middle in opposite sides; the runner or blade presents a broad surface in cross-section, extends in advance of the body, and has the upper edge of its forwardly-extended portion curved inwardly, its edge-plate conforming with the edge curvature of the blade and overlapping the upper front edge of the body.

SLEEVE-BLANK.—Robert Phillips, New Albany, Ind. The blank is formed with oppositely-sloped edges, a point, and a notch.

FABRIC.—Israel Fisher, Manhattan, New York city. The leading feature of the design consists of a number of mounted officers and foot-soldiers in marching order, with standard bearers in the van carrying American and Cuban flags. The standard bearers are followed by a commanding officer representing General Maximo Gomez.

BUSTLE.—Mary E. Wetherell, Boston, Mass. The leading features of the design consist in side strips which converge at the top of the bustle and diverge at the bottom and are longitudinally curved from the center. An arched skeleton frame connects the bottom and side strips.

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References to former articles or answers should give date of paper and page or number of question.

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(7684) E. R. writes: I have noticed recently in the SCIENTIFIC AMERICAN and other papers, different articles and letters on clocks, and two especially on new plans to illuminate tower clock dials. I would like to say that I experimented somewhat in this line *in 1879 and since at* various times. I used but three lights to each dial, a red one on the end of the minute hand, a green one on the hour hand, and a white or frosted one on the center post. There is no effort or intention whatever to illuminate the dial, as the time is readily ascertained by the position of the moving red and green lights in relation to the stationary white one, just as a blind man tells the time by feeling the hands and center post of a watch. I used a five foot dial, making a great number of changes at random in the position of the lights, and both myself and my assistants could readily tell the time without difficulty at a distance of 2,400 feet. The ordinary ground glass illuminated dial in general use will not do half as well, although often twice this diameter. They are also expensive both in first cost and in the amount of light required. By rigging the lamps out on light extension pieces attached to the ends of the hands the effect is had of apparently much longer hands and larger dials, thus increasing the distance at which it may be seen. I took no patent out on this, but give it to the world for what it is worth. Electric lamps are of course used, the various connections being easily made by means of wings and brushes. All the public needs to learn and remember is, red minutes, green hours, and white centers. A. Red and green are the nautical colors for signals, and perhaps were chosen for this reason; but a yellow light is brighter than a green one, and seen in close contrast with a white light can be readily distinguished from the white light. With this modification, the plan of our correspondent seems a very practicable as well as an economical one for enabling one to read the position of the hands of a distant clock in the night.

(7685) A. F. T. asks: Does paint affect the efficiency of lightning rods when applied to rod? A. No, not in the slightest degree.

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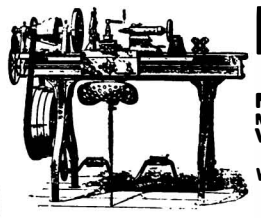

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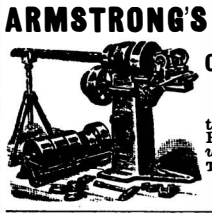

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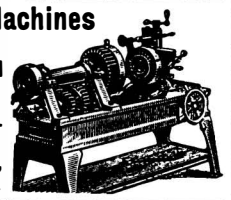

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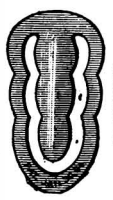

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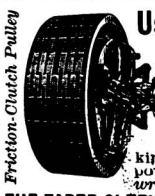

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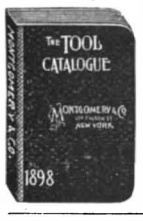

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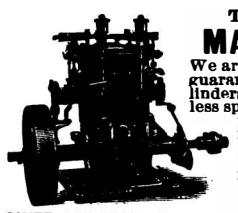

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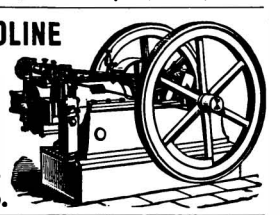

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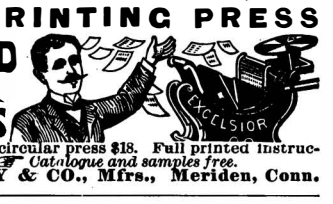

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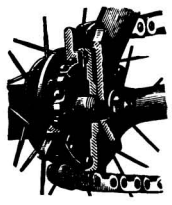

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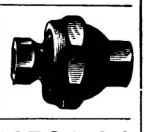

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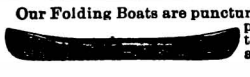

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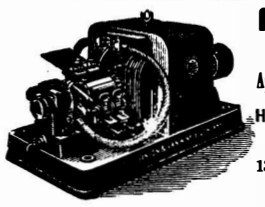
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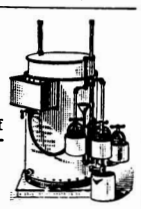

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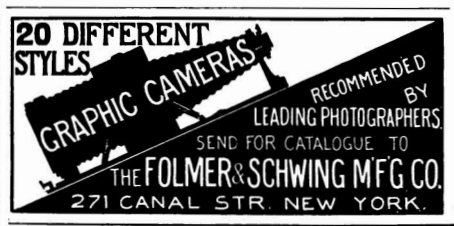
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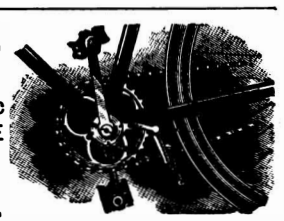

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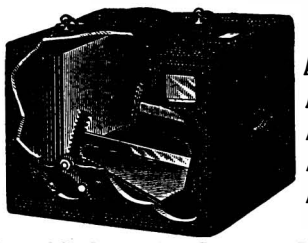

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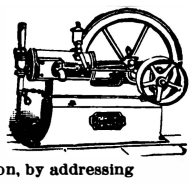

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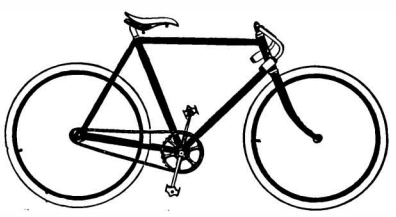

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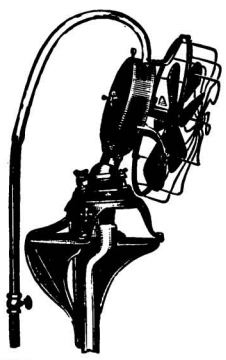

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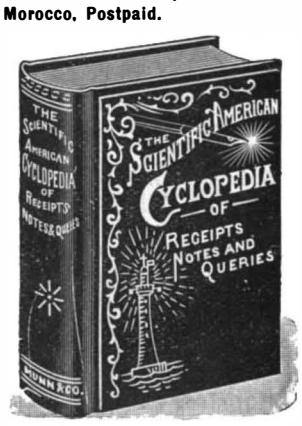

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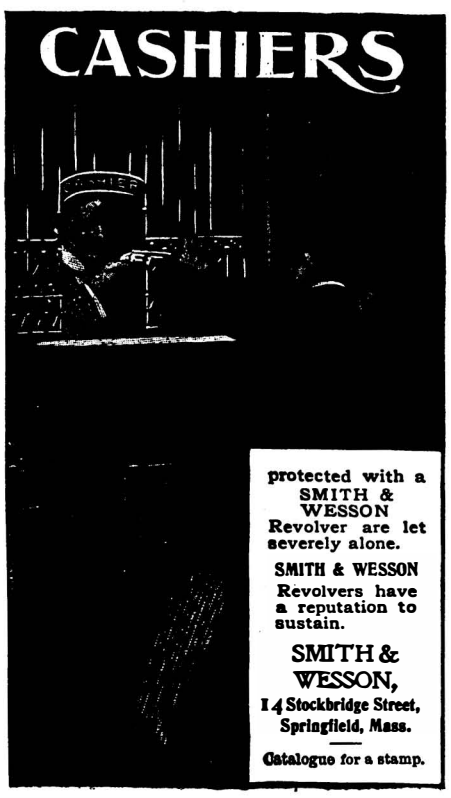

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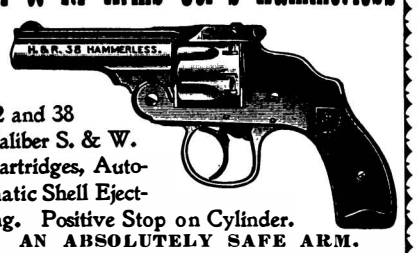

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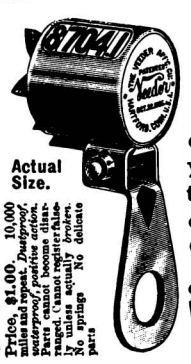

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